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**CEDAR INTERNAL CORRESPONDENCE**

DATE: January 6, 1993

TO: Dave Hoppel

FROM: J. R. Tomblin
JRT-08-93

CC: Craig Keese
Geoff Pratt
Bob Christian

SUBJECT: ODCB/DCA Requirements

---

Based on our current thinking, I see the ODCB/DCA balance for 1993 as follows:

| Product | Volume | AI | # DCA | # ODCB | |
|---|---|---|---|---|---|
| 3# Propanil | 800 | 2,400 | 1,800 | 2,070 | (assumes Crystal deal) |
| 4# Propanil | 300 | 1,200 | 900 | 1,035 | |
| PROPANEX | 25 | 100 | 75 | 85 | |
| WHAM | 100 | 400 | 300 | 345 | |
| WHAM 80% | 300 | 240 | 180 | 205 | |
| STAM | 675 | 2,700 | 2,025 | 2,330 | |
| Tech | 2,000 | 2,000 | 1,500 | 1,725 | |
| Flake | 600 | 600 | 450 | 520 | |
| DCPI | 1,000 | | 700 | 805 | |
| DCA | 1,000 | | 1,000 | 1,150 | |
| | | Total | 8,930 | 10,270 | |

Based on current supply agreements and future positioning on ODCB supply, the purchases from each supplier should be as follows:

| | | |
|---|---|---|
| Monsanto | 5,500 | required by contract |
| PPG | 3,200 | required by contract |
| ICI (Lifson) | 1,000 | future positioning and lower price |
| ?? | 570 | Probably Monsanto, but up for grabs depending on Cedar needs |
| Total | 10,270 | |

Obviously, this needs to be monitored closely as we proceed. Our requirements could change and the above will not be spread evenly across the entire year. Our primary obligation is to Monsanto, then to PPG; after that we have some flexibility. On the other hand, it is, of course, desirable to spread our take from each of these as evenly as possible rather than an "all and then another one" scenario. (Good luck, Bob!)

9349898

September 23, 1992

**MEMORANDUM**

Fm: John Wagner

To: David Hoppel

cc: M.J. Pocrass
Tom Lodice
Neil Robbins

Re: DCA Bottoms Disposal Costs

The current disposal costs associated with the landfill of the DCA bottoms at Chemical Waste Management's hazardous waste landfill in Carlyss, LA, (based on a 64-drum capacity truck) are as follows:

| | |
|---|---|
| Epoxy-lined, 18/16 steel 55 gallon, open-head drums ($24.09 each) | $1542 |
| Disposal cost in secure (Subtitle C) landfill ($90/drum) | 5760 |
| Transportation, per truck | 1083 |
| In-house labor (1 man/$80 per day/1.5 days) | 120 |
| | $8,505 |

Disposal cost per gallon (3392 gallons per truck) = $2.51

33.4 trucks per year x $8,505 per truck = $284,067

**** Generation rates for DCA bottoms were computed based on figures from Jan 1 to May 12, 1992, and determined to be 24,154 pounds or 2,176 gallons per week.

On September 23, 1992, Peoria Disposal Company, submitted a proposal as a result of discussions that have been ongoing for several months. This option presents cost savings for the disposal of the DCA bottoms and would present less exposure to persons loading the waste. The waste would be going to a hazardous waste landfill as with Chemical Waste Management, but shipped, and therefore priced, as bulk.

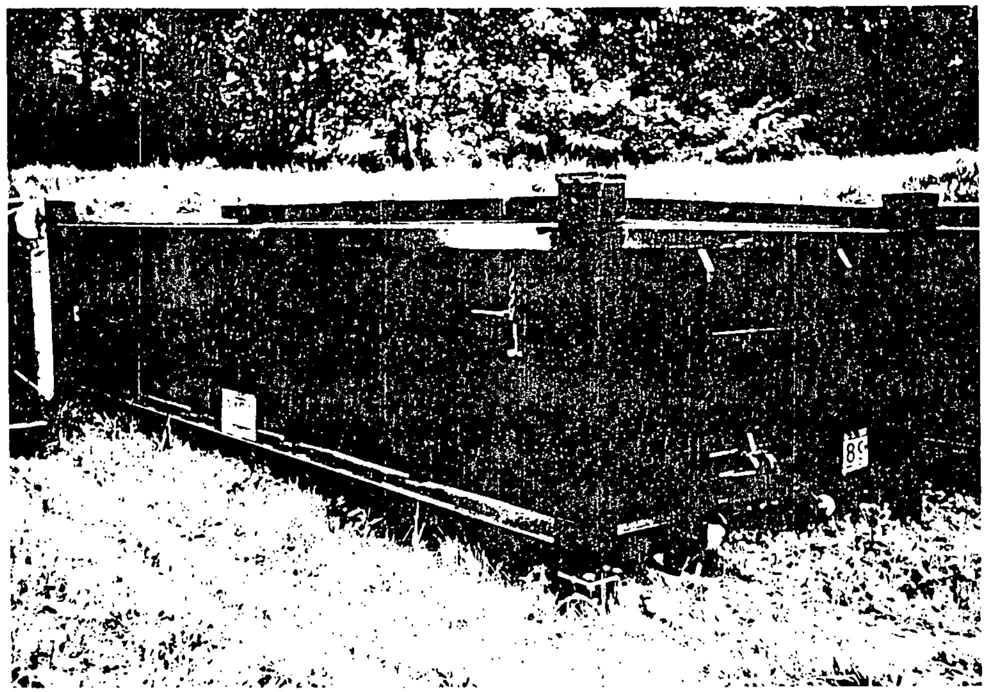
The disposal costs associated with this option based on a 2,650 gallon load in a supersac-lined box carried on a truck (see photo) are as follows:

| | |
|---|---|
| Box bag (20 yard supersac) | $300 |
| Disposal cost in secure (Subtitle C) landfill (2650 gallons/202 gallons per yard = 13.1 yards x $165/yard) | 2,162 |
| Transportation, per truck | 1,566 |
| Taxes ($18.18/yard) | 238 |
| Box rental | 85 |
| In-house labor (1 man/$80 per day/.25 days) | 20 |
| Total cost | $4,371 |

Disposal cost per gallon (2650 gallons per truck) $1.65

42.7 trucks per year x $4,371 per truck = $186,642

**COST SAVINGS PER YEAR = $97,425**



**CEDAR INTERNAL CORRESPONDENCE**

cc: B. Christian
B. Gastrock
K. Howard
T. Lodice
M. Pocrass
N. Robbins
P. Schweikert

To: J. R. Tomblin

From: D. V. Hoppel

Date: August 26, 1992

Subject: **DCA and Propanil Capacities**

We have reviewed the performance of DCA and the Propanil units during the first two quarters of the year. Pat Schweikert has issued a summary which is attached. First of all, I think that we could count on about 10MM lbs of DCA per year since we know that we do not have the full twelve months available to us (major maintenance and inspection shut downs). Sale of 99+% DCA is mentioned and I would like to stress that for every pound of 99+% DCA sold, is equivalent to using up 1.7 lbs of normal grade DCA.

We do have debottlenecking ideas for each step that could relatively easily be implemented. The one exception is the distillation. If we cannot reduce the amount of 2,3 isomer to be separated, the only way we can think of to substantially improve capacity is to put in another distillation unit.

Hopefully this information can be the basis for deciding on future work in the unit, and will give you better information on the quantities of DCA and Propanil available for sale. Let me know if you have any questions.

DVH

Date: August 25, 1992

To: D. Hoppel

CC: M. Pocrass
R. Johns
T. Lodice
K. Howard

From: P. Schweikert

Subject: DCA Production Capacity

In an effort to determine the current capability of the DCA department, production data from March to June of 1992 was examined. Each of the three major process steps was studied as well as the DCA requirements for propanil production. An on-stream factor of 90% was used in the calculations. The following results are expressed as annual production on a 98% basis of 3,4-DCA (propanil production is expressed as propanil tech*):

| Process Step | MM Lbs. |
|---|---|
| Nitration .......... | 12.00 |
| Hydrogenation ...... | 12.38 |
| Distillation ....... | 11.24 |
| Prop. DCA Demand ... | 12.71 |
| Propanil Prod. (*) . | 17.35 |

Production of 99% 3,4-DCA reduces the unit's capacity to just 6.58 MM pounds per year.

At present Propanil production is slightly ahead of DCA, which is confirmed by what was actually observed during April and May.

The difference between the rates of the two DCA process reactions needs to be erased. Improvements in nitration reaction cooling and ODCB charge accuracy should accomplish this.

It is no suprise that the distillation appears to be the process limiting step since product losses only account for some of the differences between it and the rates of the two reactions. The necessary improvements in distillation rate could be achieved by improving the quality of the crude DCA feedstock rather than high cost equipment modifications. Reduction in 2,3 isomer, higher purity ODCB and lower heavy component formation in the hydrogenation reaction could all be helpful in this area.

Patrick Schweikert

Cedar Internal Correspondence

To: Mr. D. Hoppel July 31, 1992

Subject: DCA Operations

Copies: Bill Gastrock, M. J. Pocrass, Neil Robbins, Greg Satterfield, Tom Lodice, Pat Schweikert

From: K. J. Howard

## SUMMARY


Waste disposal is a very large portion of the cost of producing DCA. This is exactly what was expected going into the project. The following report attempts to sort out what causes the wastes to be generated and their affect on the performance of the department.

Lights or low boilers are generated throughout the process starting with the raw materials and ending in the distillation step. A table detailing the sources of the lights, Table 1, is attached. By far the largest source is the nitration step where 2,3-DCNB is generated which accounts for almost 70% of the total lights. This obviously results in a large yield loss and because of the difficulty in separating the 2,3-DCA from the product it also directly affects the distillation capacity. If no 2,3-DCNB were produced, the distillation capacity would be on the order of 23 million pounds of DCA per year.

Taking Direct Operating Expenses, Indirects, and Overheads as fixed costs ($254,331 for June 1992) results in change of $305,100 per year for every 1 MM #/yr. So a change of +/- 1 % 2,3-DCNB in the nitrator product would result in a change of 1.2 MM #/yr of distillation capacity which would result in a difference of $366,120 in fixed costs. It would also change the costs for disposal, raw materials, product losses, and steam by $137,700. So reducing 2,3-DCNB in the nitrator from 10% to 9% would reduce the total costs by $503,820 and increase capacity by 1.2 MM #/yr.

Distillation bottoms are produced mainly in the hydrogenation step. But, not all. Every pound of trichlorobenzene in the ODCB which is nitrated ends up in the product and in the bottoms. And, some heavies can be produced during the distillation itself, else, why add the lime to the distillation. <u>Intuition</u> says that the quantity of catalyst used in the hydrogenation step has the largest affect on the quantity of heavies produced. Lime, being a solid, is obviously going to come out of the distillation step as bottoms.

**LIGHTS**

The cost of each of the sources of lights can be developed adding together raw materials, disposal, steam, rate variance, and affects on DCA losses in the distillation, as follows.

| SOURCE | RAW MTL | DISP. | STEAM | RATE VAR | DCA LOSS | TOTAL |
|---|---|---|---|---|---|---|
| PDCB | 0.48 | 0.38 | 0.14 | 1.81 | 0.02 | 2.83 $/CWT DCA |
| 2,3-DCNB | 7.14 | 6.04 | 0.23 | 17.25 | 0.37 | 31.03 |
| UNRXTD ODCB | 0.14 | 0.51 | 0 | 0 | 0 | 0.65 |
| DECLRS | 0.94 | 0.80 | 0.03 | 1.00 | 0.05 | 2.82 |

Elimination of all of the para-Dichlorobenzene from the incoming ODCB would result in 2.83 $/CWT of DCA on a production capacity of 800,000 lbs per year above present 10 MM lbs/yr. Since the pDCB presently averages 0.6 %, this means that each 0.1 % of pDCB is costing us about 133,000 lbs/yr in production and about $50,900. From this it is possible to evaluate various qualities of ODCB from the suppliers.

Similarly, evaluation of the affect of various catalysts upon dechlorination is possible.

Total elimination of all of the 2,3-DCNB from the nitrator product would theoretically allow the distillation capacity to approach 23 MM lbs/yr. But, the rest of the department could not possibly support that rate.

A rate of possibly 14 MM lbs/yr is attainable by the nitrator and hydrogenator. This would require 6 & 2/3 hydrogenator batches per day and 3 & 1/3 nitrator batches per day. Both of these have been demonstrated, but some minor modifications to the department may be necessary for long term reliability.

Reducing the amount of unreacted ODCB in the nitrator product is possible. The problem appears to be caused by slight variations in the weight of ODCB charged to each batch. Either considerable work to correct the weigh scale fluctuations or the use of a mass flow meter on the ODCB would allow some reduction in the excess ODCB in each batch.

**BOTTOMS**

| Material in bottoms | LBS/CWT DCA | % |
|---|---|---|
| 3,4-DCA at end of Dist. | 1.61 | 13.5 |
| Trichloroanilines | 0.10 | 0.8 |
| TCAB | 3.05 | 25.6 |
| All other Org. Heavies | 2.43 | 20.4 |
| Lime | 2.59 | 21.8 |
| DILUENT (Lights) | 2.13 | 17.9 |
| TOTAL | 11.90 | |

This table represents the materials being drummed out of V-318 to be sent for disposal. If, there is a significant weight of trash, samples, contaminated insulation, and other items, the actual weight of materials presently being identified as bottoms would be more than 11.9 lbs/CWT DCA.

Approximately 15 to 20 % of the 3,4-DCA left in the bottoms is a result of column drainback when the distillation is stopped. The remainder is left in the bottoms due to loss of heat transfer and boilup. It gets to be **really** a mess trying to figure out how much could be recovered if the percent heavies in the hydrogenation were less and how much is due to the solids which must be fluidized by **something.**

The TCAB and all other heavies stand out as the biggest loss. Together they account for 5.48 lbs/CWT of DCA produced. The laboratory and the plant results both indicate some correlation between the quantity of catalyst used in the hydrogenator and the amount of TCAB and heavies produced. A higher usage of catalyst tends to reduce these materials. If these materials could be reduced from 5.48 to 3.5 lbs/CWT by increasing the catalyst usage by **another** 0.5 KG, it would result in annual **net** savings of $150,000 per year for increased DCA yield and reduced bottoms disposal cost.

Trichlors are sneaky. They do not account for much of the bottoms quantity. The reason for this is that <u>90 %</u> of the trichlors are removed from the distillation system with the product, unless we are trying to produce 99 % DCA when only 50 % are removed with the product. Producing a 98 % DCA requires a reflux to forward flow ratio of 1:3, whereas 99 % DCA requires a 3:1 ratio. **About** 1/3 of the trichlors are due to the trichlors in the ODCB and the remainder come from "thermal dechlorination" reactions in the hydrogenator.

Lime is a quandary. **It works!** Monsanto had one distillation decomposition during their long production history. They were reasonably certain that lime was not added to that batch. Their research personnel suggested using ammonia for the stabilization, but their production personnel would not even try it once! We had a decomposition using ammonia. DuPont does not use lime, but their distillation is continuous and they do have organic high boiling amines present from the hydrogenation. Lime obviously adds solids to our distillation bottoms which must be suspended and agitated vigorously enough to maintain good heat transfer. Lime ends up in our distillation bottoms.

A diluent is necessary to allow removal of the bottoms from the distillation pot and to allow drumming. It is **possible** that a more volatile diluent could be used, which **might** later be recovered immediately before drumming. Reduce the amount of lime and it **should** be possible to reduce the amount of diluent.

**SUGGESTIONS**

1. Use the best ODCB available. Both pDCB and trichlors should be minimized.

2. Increase the reliability of the ODCB charge to the nitrator. Mass flow meter and improvement of the recycled ODCB from V-303.

3. Increase the nitrator cooling capability. The location of the existing cooler is poor, more heat transfer area is needed, and the refrigeration system is not kept at highest efficiency at all times.

4. Investigate catalyst optimization. Type, usage, and activity.

5. Replace the hydrogenation fin tube cooler with a cooling tower.

6. Continue efforts to improve the 3,4 to 2,3 ratio in the nitrator.

7. Investigate means to reduce lime usage **SAFELY,** such as replace the lime with a cheap high boiling alkaline diluent.

8. Use a valve on the bottom of the distillation column to prevent packing runback while emptying bottoms out of the distillation pot.

| Where do all the DCA Lights come from ? | | | |
|---|---|---|---|
| Source | Description | # Lights/ # DCA | % of Total Gen. |
| **Raw Mtls.** | p-DiClBenzene | 0.0068 | 4.14 |
| | Tri-ClBenzenes | 0.0008 | 0.49 |
| | Total from Raw Mtls | 0.0076 | 4.62 |
| **Nitration** | * 2,3-DCNB | 0.112 | 68.13 |
| | Un-reacted ODCB | 0.01 | 6.08 |
| | Others | 0.0017 | 1.03 |
| | Total from Nitration | 0.1237 | 75.24 |
| **Hydrogenation** | Hydro-Dechlorination | 0.0098 | 5.96 |
| | Thermal-Dechlorination | 0.005 | 3.04 |
| | Unconverted DCNB | 0.002 | 1.22 |
| | Total from Hydrogenation | 0.0168 | 10.22 |
| **Distillation** | * 3,4-DCA (Imperfect Sep.) | 0.0108 | 6.57 |
| | Water and Others | 0.0055 | 3.35 |
| | Total from Distillation | 0.0163 | 9.91 |
| | **Total Lights Generated** | 0.1644 | 100.00 |
| | Dilution of Bottoms | -0.0213 | -12.96 |
| | **Total Lights to Disposal** | 0.1431 | 87.04 |

**CEDAR INTERNAL CORRESPONDENCE**

cc: K. Howard
M. Pocrass
N. Robbins
P. Schweikert
J. Wagner

To: J. R. Tomblin

From: D. V. Hoppel

Date: July 15, 1992

Subject: **DCA Waste Disposal Costs**

We continue to run above plan on DCA waste disposal costs. This is the largest budget variance we have for the first half of the year. One issue is that the original budgeted amount (ca. $5/cwt DCA) was insufficient. In May we updated our estimate of waste disposal costs to $8.7/cwt DCA. The actual figures for the second quarter calculate out to $12.09/cwt (see attached summary). The bottoms disposal costs seem to be about where predicted, allowing for a somewhat increased shipping rate during the second quarter to dispose of bottoms that we had inventoried. Lights disposal is another issue. Transportation and disposal costs both ran at about 50% over predicted levels.

In order to get this situation rectified, I am requesting that MJ arrange for a monthly report on disposal cost details. This report should include generation rate and cost analysis. Hopefully we can develop the data to better understand this problem, and to better predict and control the costs.

DVH

DCA WASTE DISPOSAL COST SUMMARY

| I. AS IS NUMBERS | APR | MAY | JUN | 2Q | MAY |
|---|---|---|---|---|---|
| LIGHTS | | | | | ESTIMATE |
| AMOUNT SHIPPED (LBS) | 189,365 | 85,760 | 122,620 | 397,745 | |
| DISPOSAL COST ($) | 71,029 | 93,114 | 53,334 | 217,476 | |
| TRANSPORTATION COST ($) | 3,942 | 1,650 | 1,876 | 7,467 | |
| TOTAL COST ($) | 74,970 | 94,764 | 55,210 | 224,943 | |
| UNIT COST ($/CWT LIGHTS) | 39.59 | 110.50 | 45.02 | 56.55 | 36.26 |
| BOTTOMS | | | | | |
| AMOUNT SHIPPED (LBS) | 87,948 | 128,840 | 227,440 | 444,228 | |
| DISPOSAL COST ($) | 22,140 | 25,706 | 40,698 | 88,544 | |
| TRANSPORTATION COST ($) | 3,857 | 1,083 | 7,950 | 12,890 | |
| TOTAL COST ($) | 25,997 | 26,789 | 48,648 | 101,434 | |
| UNIT COST ($/CWT BOTTOMS) | 29.56 | 20.79 | 21.39 | 22.83 | 21.49 |
| | | | | | |
| DCA PRODUCED (LBS) | 969,189 | 968,487 | 762,113 | 2,699,789 | |
| TOTAL DISPOSAL COST ($) | 100,967 | 121,553 | 103,858 | 326,377 | |
| | | | | | |
| II. NORMALIZED TO PER 100 POUNDS OF DCA | | | | | |
| LIGHTS | | | | | |
| AMOUNT SHIPPED (LBS/CWT) | 19.539 | 8.855 | 16.089 | 14.732 | 14.71 |
| DISPOSAL ($/CWT DCA) | 7.329 | 9.614 | 6.998 | 8.055 | 5.15 |
| TRANSPORTATION ($/CWT DCA) | 0.407 | 0.170 | 0.246 | 0.277 | 0.19 |
| TOTAL COST ($/CWT DCA) | 7.735 | 9.785 | 7.244 | 8.332 | 5.33 |
| BOTTOMS | | | | | |
| AMOUNT SHIPPED (LBS/CWT) | 9.074 | 13.303 | 29.843 | 16.454 | 15.71 |
| DISPOSAL ($/CWT DCA) | 2.284 | 2.654 | 5.340 | 3.280 | 2.92 |
| TRANSPORTATION ($/CWT DCA) | 0.398 | 0.112 | 1.043 | 0.477 | 0.46 |
| TOTAL COST ($/CWT DCA) | 2.682 | 2.766 | 6.383 | 3.757 | 3.37 |
| | | | | | |
| TOTAL DISPOSAL ($/CWT DCA) | 10.418 | 12.551 | 13.628 | 12.089 | 8.71 |

| III. SUMMARY | LIGHTS | | BOTTOMS | |
|---|---|---|---|---|
| | MAY EST. | 2Q ACTUAL | MAY EST. | 2Q ACTUAL |
| $ PER 100 LBS OF WASTE | | | | |
| TRANSPORTATION | 1.26 | 1.88 | 2.92 | 2.90 |
| DISPOSAL | 35.00 | 54.68 | 18.57 | 19.93 |
| TOTAL | 36.26 | 56.55 | 21.49 | 22.83 |
| | | | | |
| $ PER 100 LBS OF DCA | | | | |
| TRANSPORTATION | 0.19 | 0.28 | 0.46 | 0.48 |
| DISPOSAL | 5.15 | 8.06 | 2.92 | 3.28 |
| TOTAL | 5.33 | 8.33 | 3.38 | 3.76 |

| | MAY EST. | 2Q ACTUAL |
|---|---|---|
| TOTAL COST ($/CWT DCA) | 8.71 | 12.09 |

**CEDAR INTERNAL CORRESPONDENCE**

DATE: 5/22/92

TO: John Whitsitt

FROM: Geoffrey L. Pratt

cc: Neil Robbins
Bob Christian

SUBJECT: ODCB Pricing - PPG

We have now confirmed through PPG's Customer Service that the price of ODCB, effective March 17, 1992 is $0.38 per pound delivered and we will be issued a credit for all invoices covering material shipped after that date. The credit document will identify the individual invoices and the subtotals to be applied to each and the total credit should equal $14,777. We should probably check that they have covered all of the invoices billed at $0.40 in error since March 17.

GLP

Geoffrey L. Pratt

mc

xc: N. Robbins
B. Christian
M. Pocrass
K Howard
B. Gastrock
T. Lodice
J. Satterfield

Info
DH
4/29

**CEDAR INTERNAL CORRESPONDENCE**

DATE: 4/22/92

TO: Randal Tomblin

FROM: Geoff Pratt

cc: Craig Keese
Dave Hoppel

SUBJECT: ODCB Supply

I have discussed ODCB capacity and production levels with each of the three domestic suppliers and have derived a supply demand scenario described in the attached Exhibit A. I have been unable to obtain data on the production capability of the Brazilians. It is interesting to compare this data with that presented in the appropriation for the DCA project. This data from 1989 is reproduced in Exhibit B.

Regarding domestic capacity, the main difference between the two exhibits is that Monsanto's capacity for ODCB has been doubled by the modifications made to their plant since 1989. Current total domestic production is estimated at 52 million pounds versus 50 million pounds estimated in 1989. A major event which has affected production since 1989 is Monsanto's reformulation of much of its Lasso, thus reducing its demand for MCB and its capability to produce ODCB at capacity. It is believed that they are producing 100 million pounds per year or less of MCB which limits their ODCB capacity to roughly 7 million pounds. This is confirmed somewhat by their statements that they are able to supply the contracted 5.5 million pounds of ODCB to Cedar and could provide an additional one million pounds, at a premium price, which they would obtain by taking the material from current small volume customers.

Exhibit A displays the ODCB consumption figures generated at the time of the DCA appropriation request. If these figures are still valid, one would assume that there is still a modest surplus of ODCB.

There has been a shift in the supply relationship since 1989. Standard Chlorine is now providing all of du Pont's and Rhone-Poulenc's ODCB requirements. If Standard is running at 30 million pounds per year and Rhone-Poulenc is consuming 8 million pounds then du Pont is consuming 22 million pounds, a drop of approximately 11 million pounds from 1989. This is consistent with Cedar's impact on the ODCB market. du Pont contracted for roughly 11 million pounds of ODCB for 1992 from PPG on the assumption that they would be running their DCA plant at its estimated capacity of 30 million pounds. At some point in the late fall of 1991 or early 1992 they unceremoniously dumped PPG as a supplier. PPG has indicated that they could supply Cedar with up to 12 million pounds of ODCB.

There is a strong rumor in the industry that Monsanto may exit the chlorinated benzene business. Should this occur, PPG could pick up the lost ODCB supply for Cedar. Also Standard has also indicted that they can increase their ODCB production significantly. Thus it would appear that our DCA requirements will be covered adequately.

It was predicted in the DCA Capital Appropriation Request that the demand for DCPI would gradually fall due to lower demand for Linuron and Diuron. I have no specific knowledge of the trends in either Propanil, Linuron or Diuron but Bayer's sudden interest in being a ODCB supplier to Cedar might be a result of falling worldwide demand for Linuron/Diuron, combined with their loss of the supplier position for ODCB to Staveley. Lower Linuron/Diuron demand would also make du Pont more aggressive in the DCA market even at their new estimated production level of 20 million pounds, which would put further pressure on Bayer's ODCB outlet.

Two other factors contributing to the chlorinated benzene puzzle is the loss of Phillips paradichlorobenzene business by Monsanto, with Standard Chlorine the new long term supplier. This will put additional pressure on Monsanto to consider their long-term position in the chlorinated benzene business. There may be some downward pressure on Bayer's capacity for total chlorinated benzenes due to their decision to exit the PPS market which is a consumer of paradichlorobenzene.

The major conclusion from this analysis is that Cedar's supply of ODCB should be safe for the foreseeable future. I would appreciate any comments on the data or conclusions so that I can make appropriate corrections. In the meantime, the contract from PPG for up to 5 million pounds per year of ODCB should be ready for review before the end of April! The price of ODCB from PPG dropped to $0.38 per pound delivered effective March 17, 1992.

Geoff Pratt

mc

Attachment

**EXHIBIT A**

**ODCB CAPACITY 1992 - MM lbs**

| | MCB | PDCB | ODCB |
|---|---|---|---|
| PPG | 40 | 30 | 20 (15) |
| Standard | 150 | 75 | 50 (30) |
| Monsanto | 176 (100)* | 20 | 12 (7) |
| Bayer | 187 | 75 | 46 |
| Enchem | 33 | 9 | 4 |
| Atochem | 22 | 15 | 7 |
| | | | 139 (109) |

*figures in parentheses are production levels.

| | | |
|---|---|---|
| ODCB uses | 40 | Propanil |
| | 40 | DCPI |
| | 3 | TCC |
| | 8 | Miscellaneous |
| | 9 | Surplus |

**EXHIBIT B**

**ODCB SUPPLY DATA FROM CAR (1989)**

**MM LBS**

| | Capacity | Production |
|---|---|---|
| Standard Chlorine | 50 | 30 |
| PPG | 20 | 17 |
| Monsanto | 6 | 3 |
| | 76 | 50 |

**ODCB USE FROM CAR (1989)**

| | | |
|---|---|---|
| 33MM lb | to | du Pont |
| 8 | to | Rhone-Poulenc (Stavely) |
| 5 | to | Miscellaneous |
| 46 | | |
| 4 | to | Surplus |

# Cedar Chemical Corporation

Suite 2414 Clark Tower 5100 Poplar Avenue Memphis, TN 38137 (901) 685-5348

Copy To:
DAVE H.
Neil R.
MJP

Return Fax No. (901) 684-5398

Fax #

Date: April 21, 1992

Attn: Bob Christian
cc: John Whitsitt

Firm: West Helena

From: Randal Tomblin

Firm: Cedar - Memphis

No. of Pages: 1 Including Cover

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Bob:

I have had discussions with Bayer of Germany and their U.S. company, Miles,Inc. about purchasing some ODCB from them.

They would like for us to try some of their material and I have agreed to the following:

3 - isotanks of Pure Grade ODCB meeting the attached specs, approximately 35,000 lbs. each for a total of 105,000 pounds

Price is $0.34/lb. delivered, duty paid to West Helena

Material will be shipped promptly with expected arrival in 4-6 weeks.

Payment 30 days after delivery at West Helena

Certificate of Analysis required

Please issue a confirming purchase order to:

Miles, Inc.
Mobay Road
Pittsburg, PA 15205-9741

Attn: Mr. Shewak Hingorani, Marketing Manager

If you require additional Information, please give me a call.

RT

# o-Dichlorobenzene

| Symbol: | PR-SNR: | Form supplied: |
|---|---|---|
| ADBPM | 032085-00 | TECHNICAL |
| ADBSH | 512982-01 | PURE |

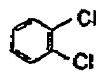
CAS No.: 000095-50-1

mm = 147.0 g/mole

NET

Empirical formula: $C_6H_4Cl_2$

Structural formula:



VHP: 301

**Germ.:** o-Dichlorbenzol
**Franz.:** o-Dichlorobenzène
**Span.:** o-Diclorobenceno
**Port.:** o-Diclorobenzeno

**Description:** *Colourless to pale pink liquid with a characteristic odour.*

GB Organische Chemikalien
Geschäftsfeld Industriezwischenprodukte

Bayer



| Technical data: | Technical: | Pure: |
|---|---|---|
| Assay (gas chromatography): | 84—86% | min. 99.5% |
| Sum of p-dichlorobenzene + trichlorobenzene: | —— | max. 0.5% |
| **Characteristic data:** | | |
| Solidification point (dried): | approx. —23 °C | approx. —17 °C |
| p-Dichlorobenzene: | approx. 15% | —— |
| m-Dichlorobenzene: | approx. 0.5% | —— |
| Density $d\frac{20}{4}$: | approx. 1.303 | approx. 1.306 |
| Boiling interval: | approx. 1 °C | —— |
| Boiling point: | approx. 180 °C | —— |
| Flash point: | approx. 66 °C | approx. 68 °C |

*Technical data are specification values and are subject to constant monitoring. Characteristic data provide further information about the product and are not subject to constant monitoring.*

**Uses:**

Used in the chemical industry, for example as an intermediate for the synthesis of:
1. Coatings and auxiliaries.
2. Agrochemicals.
3. Chemical/technical products.

**Standard packing:**

Rail tanker / road tanker.
Rolling channel drum, contents approx. 250 kg.

**Storage:**

If correctly stored and kept in the original sealed package, the shelf life is at least 2 years.

**Toxicity and hazards:**

Labelling according to EC Directives: "Xn" harmful.
R 20: Harmful by inhalation.
S 24/25: Avoid contact with skin and eyes.
See information on the specifications from the OC Business Group, the section on the handling of chemicals and the safety data sheet.

**Shipping regulations:**

| Dangerous materials classes: | | |
|---|---|---|
| GGVE/GGVS: | 6.1 | 15C |
| RID/ADR: | 6.1 | 15C |
| ADN-R: | 3 | 4 |
| IMDG CODE: | 6.1 | UN NO.1591 |

01. 10. 1989
(Cancels edition dated Nov. 1, 1986)

N. Robbins

PPG Industries, Inc. 1761 Summerlake Drive Chesterfield, Missouri 63017 (314) 532-7740

Chemicals Group

RECEIVED
JAN 15 ...
A...

January 9, 1992

Mr. Geoffrey L. Pratt
Director of Custom Manufacturing
Cedar Chemical Corporation
5100 Poplar Avenue
Memphis, TN 38137

Dear Geoff;

Confirming our several discussions with respect to PPG supplying ODCB to your plant at West Helena, we are delighted with the opportunity to participate in your requirements.

As we agreed, your price for the initial 1,500 tons is $0.40 per pound, f.o.b. Natrium, West Virginia, with tank car freight prepaid and absorbed. As we further agreed, you will attempt to take this amount of material as soon as is practical.

As you requested, we are further able to commit to an annual volume level of 2,500 tons per year and I will be in soon to initiate a contract proposal indicating this volume for an initial term of 5 years.

We appreciate this opportunity to further our emerging relationship with Cedar Chemical. Should you have any questions or need additional information please call me.

Cordially,

Robert M. Herrell
Account Manager

cc: Bill Fetter
Jim Randall

December 31, 1991

Fm: John Wagner

To: David Hoppel

cc: Gene Pearce
M.J. Pocrass
Neil Robbins
Tom Lodice
Ken Howard

Re: DCA Bottoms Disposal Alternative

The enclosed calculations represent savings that CEDAR will realize by using an alternative to incineration as a method of disposal for the DCA still bottoms distillation residue.

The waste will be drummed using procedures allowing one man to fill the drums, stage them at the loading dock, and load the truck. The drums will be disposed of in Chemical Waste Management's hazardous waste landfill in Carlyss, LA.

JW

## DISPOSAL ALTERNATIVE FOR DCA BOTTOM DISTILLATION RESIDUE

Since disposal costs to landfill are based on a per drum cost and the disposal costs to incineration are based on a per pound cost, I will use a full truck cost to each site to determine a per gallon disposal cost in order to make a meaningful comparison. All costs have been confirmed with the respective suppliers.

Current disposal costs of the bottom distillation residue going to incineration at ENSCO in El Dorado, AR for a full truck of drums (based on a 66 drum truck with 55 gal of waste per drum) are as follows:

| | |
|---|---|
| Unlined, reconditioned steel 55 gallon, closed-head drums ($8.50 each) | $561 |
| Incineration cost, per truck | 41,720 |
| Transportation, per truck | 600 |
| Drum cost, per truck ($8.50 per drum) | 561 |
| In-house labor (3 men/$80 per man/1.6 days) | 384 |
| Total cost | $43,265 |
| Disposal cost per gallon (3630 gallons per truck) | $11.92 |

---

The disposal costs associated with the landfill of the bottoms at Chemical Waste Management's hazardous waste landfill in Carlyss, LA, (based on a 66 drum truck) are as follows:

| | |
|---|---|
| Epoxy-lined, reconditioned steel 55 gallon, open-head drums ($14.50 each) | $957 |
| Disposal cost in secure (Subtitle C) landfill ($80/drum) | 5280 |
| Transportation, per truck | 1000 |
| In-house labor (1 man/$80 per day/1.5 days) | 120 |
| | $7,357 |
| Disposal cost per gallon (3630 gallons per truck) | $2.03 |

**Cost savings per gallon** **$9.89**

Target production for DCA was reached on November 15, 1991. Using inventory figures between that date and December 30, the DCA bottom distillation residue is being generated at a rate of 29,233 pounds or 2,634 gallons per week.

| | |
|---|---|
| **Cost savings per week for landfill disposal** | **$26,050** |
| **Cost savings per year for landfill disposal** | **$1,354,600** |

The above numbers represent an annual savings that can be applied to any 12-month period beginning January 1, 1992. The actual savings to be realized in calendar year 1991, using landfill as the means of disposal for the DCA bottoms will amount to approximately **$480,000**. 1991 was a partial year using contract labor with some solidification required.

CEDAR INTERNAL MEMO
WEST HELENA PLANT

DATE: 9/8/89

TO: Randall Tomblin

FROM: John Miles

CC: B. Eissler
G. Pratt
C. Keese
✓ N. Robbins

RE: 9/7/89 meeting summary

1. ODCB supply notification: 1. Annual requirement estimate; 2. Quarterly requirement estimate; 3. 30 day order placement for up to 600M pounds/ month.

2. Tom Lodice to review Monsanto equipment supply list.

3. O.K. to start on DCNB/DCA process description with PETROFAC. Could save up to one month in overall project execution.

4. Propanil requirement review from Craig Keese: 1. Will sell 600M to 1MM liters (160M to 265M gals.) of 3LB by 12/31/89. 2. Wants to formulate and package 100M gals of WHAM by 12/31/89. 3. Will flake any excess to give total of 1.5MM lbs Tech produced in 4th QTR. 4. Will review and advise on 50WDG at Terra, especially pricing. 5. Assume 10 cent rebate on export DCA. 6. 4MM to 5MM pounds Tech equivalent for 1990. 7. Expect 500M pound of Tech sales to ICIA in February.

5. Reviewed manpower requirements for balance of 1989 and 1990. Our goal is to have three unit manning for first half of 1990 (8 more ops and 5 more maint.) and then add personnel for DCA ( 12 more ops, maint not yet defined). I will add 4 ops immediately to relieve 1989 crunch. We will also proceed on technical staff as previously agreed and will flesh out growth organization chart with timetables and numbers.

WEST HELENA PLANT

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | |
| 2 | | | | | | | | |
| 3 | DCA RAW MATERIAL USAGE | | | | REVISED PER B. GASTROCK | | | |
| 4 | | | | | | | | |
| 5 | | | | MTRL BAL | | MTRL BAL | | RAW MTR |
| 6 | MTRL | | | 2/27/89 | | PETROFAC | | COST |
| 7 | | | | | | | | |
| 8 | ODCB | | | 1.1 | | 1.137 | | |
| 9 | | | | | | | | |
| 10 | 98% H2SO4 (100%) | | SULFURIC | 0.847 | | 0.893 | | |
| 11 | | | | | | | | |
| 12 | 98% HNO3 | | NITRIC | 0.477 | | 0.489 | | |
| 13 | | | | | | | | |
| 14 | HYDGROGEN | | | 0.045 | | 0.045 | | |
| 15 | | | | | | | | |
| 16 | CATALYST (DRY) | | | 0.00045 | | 0.00056 | | |
| 17 | | | | | | | | |
| 18 | SODA ASH | | | 0.0185 | | 0.016 | | |
| 19 | | | | | | | | |
| 20 | LIME | | | 0.0259 | | 0.0298 | | |

CATALYST

1% = 10 GRAM PLATINUM
IN 1 KG CATALYST

ONE TROY OZ = 31.1 GRAM

SO $\frac{\text{KG CAT} \times 10}{31.1}$ = TROY OZ.

**CEDAR INTERNAL CORRESPONDENCE**

DATE: February 14, 1990

TO: N. D. Morgan
R. Tomblin
J. Hanna
J. Whitsitt
B. Eissler
G. Pratt
J. Miles

FROM: John C. Bumpers

CC:

SUBJECT: Bank Group Plant Tour

As you know, Manufactures Hanover and BancBoston will be making a plant tour February 20-23. Since we plan to be at the West Helena Plant on Tuesday, February 20, we should be prepared to discuss the DCA Project at that time. We have asked the new Bank Group - (these are 2 of the 4 banks) to finance this project. The attached write-up has been previously submitted to the banks.

Please contact me if you have any questions.

John C. Bumpers

JCB/bd

Attachment

**TRANS-RESOURCES, INC.**

January 17, 1990

Mr. Jordan Fragiacomo
Vice President
Citibank
399 Park Avenue
New York, NY 10043

Dear Jordan:

As we discussed, I have enclosed two copies of the write-up on Cedar's DCA project. Please feel free to call me anytime if you have any questions.

Sincerely,

Ken Traub

KT/f
Enclosures

TRANS-RESOURCES, INC.

C E D A R   C H E M I C A L S

D C A   P L A N T

W E S T   H E L E N A,   A R K A N S A S

# CEDAR CHEMICALS - DCA PLANT

## Table of Contents

## I. EXECUTIVE SUMMARY

Cedar Chemicals is building a plant to produce Dichloroanaline (DCA) at its West Helena, Arkansas production facility. DCA is the major raw material for the production of Propanil, a rice herbicide produced at West Helena. In 1989, Cedar had a 22% share of the U.S. Propanil market and purchased about 4 million pounds of DCA. As a result of recent product introductions and marketing initiatives, Cedar expects its Propanil sales to increase - thereby increasing its demand for DCA. In addition to its own captive needs for DCA, several companies have already expressed their interest in purchasing DCA from Cedar. This reflects a tight supply situation in which there is only one U.S. producer of DCA. Cedar's entry into the production of DCA has been facilitated by a favorable arrangement in which Monsanto provides much of the equipment and technology at almost no cost to Cedar. This project represents an important strategic step for Cedar in which backward integration secures a strong position in the Propanil/DCA market. The DCA project will require about a $6 million investment in 1990 and is expected to generate operating income well in excess of $2 million per year starting in 1992.

1991 1992
3.5m 6.6m G.M.

## II. MARKET CONSIDERATIONS

### A. Captive Needs - Propanil

Cedar is currently the second leading producer of Propanil, behind Rohm & Haas (R&H). In 1989, R&H had about a 60% share of the U.S. market and Cedar had a 22% share. The only other significant Propanil producers in the U.S. are Cumberland Chemical and Retzloff, both of which are thinly capitalized and may be exiting the market soon. Based on 1989 sales, Cedar currently produces about 5.2 million pounds per year of Propanil. Since a pound of Propanil requires 0.76 pounds of DCA, Cedar currently purchases about 4 million pounds per year of DCA. This volume alone is sufficient to justify Cedar's backward integration into the production of DCA.

Cedar expects to increase its Propanil market share by capturing lost volume from the struggling Cumberland Chemical and Retzloff and aggressively obtaining share from R&H. R&H's success is primarily due to the wide recognition of its branded product called Stam. Cedar will increase its market share in both the high and low end of the Propanil market. On the high end of the market, Cedar has recently developed its own branded product, called Wham, which is in many ways superior to Stam. The competitive advantages of Wham include its higher effectiveness, lower cost production, flowability and no burning or disposal problems. In addition, Wham is the only major Propanil product on the market that does not contain the solvent Isophorone, which has been associated with various health issues and could potentially be banned by the EPA. If the EPA proceeds with such a ban, Wham would be positioned to dominate the Propanil market. In addition to aggressively marketing Wham at the high end of the market, Cedar will be increasing its share in the low end of the market with attractive prices for its commodity like products - 4# and 3#. In addition to strong product positioning, Cedar believes it has a competitive advantage over R&H due to superior packaging, strong PR and excellent relations with distributors. Considering the weak position of the number 3 and 4 producers, the desire of many of R&H's customers to have a second supplier, Cedar's strong product positioning at the high and low end of the market and an increased marketing and sales effort, Cedar is confident that it is well-positioned for growth and stability in Propanil.

DCA is the principal raw material for the production of Propanil. Both R&H and Cedar currently source their DCA from DuPont, the only U.S. producer of DCA. In recent contract renegotiations, DuPont has refused to agree to a long-term supply arrangement and has increased 1990 DCA prices. Dupont's long-term intentions for DCA are uncertain, but it has become clear that they cannot be relied upon as a consistent, reasonably priced supplier as Cedar grows its Propanil business. Therefore, Cedar's decision to backward integrate into the production of DCA will significantly strengthen its competitive position in Propanil while guaranteeing supply and lowering overall costs. As a result of Cedar's favorable position in Propanil, it expects to increase its sales and thereby its DCA requirements well beyond its current needs of four million pounds per year.

B. World Supply/Demand Situation

The world supply and demand of DCA is projected to be as follows (in millions of pounds):

| | Capacity | Demand 89 | Demand 90 | Demand 91 | Demand 92 |
|---|---|---|---|---|---|
| Dupont | 30 | 28 | 27 | 21 | 21 |
| Stavely | 7 | 6 | 6 | 6 | 6 |
| Bayer | 20 | 18 | 18 | 18 | 18 |
| Rhone Poulenc | 7 | 6 | 6 | 6 | 6 |
| Brazil* | | -- | 1 | 2 | 2 |
| Cedar** | | -- | -- | 5 | 8 |
| Demand | | 58 | 58 | 58 | 61 |
| Capacity | | 64 | 65 | 71 | 74 |
| Percent of Utilization | | 91 | 89 | 82 | 82 |

| | 1989 | 1990 | 1991 | 1992 |
|---|---|---|---|---|
| *Brazil capacity | 0 | 1 | 2 | 2 |
| **Cedar capacity | 0 | 0 | 5 | 8 |

The additional capacity being introduced by Cedar will be readily absorbed and will not have a disruptive effect on the market for the following reasons:

1. Cedar's current Propanil sales require about 4 million pounds of DCA and will be increasing. Since Cedar currently sources exclusively from DuPont, this portion of Cedar's DCA production will directly reduce DuPont's sales. DuPont, of course, will not be able to regain Cedar's business through price cuts or any other tactic and will have to accept a decline in sales.

2. R&H currently sources their DCA exclusively from DuPont - the sole U.S. producer. DuPont, after having lost Cedar's sales, is likely to try to regain profitability

by raising prices to R&H. R&H will be faced with the alternatives of accepting DuPont's price increases, paying the premium for the scarce foreign-produced DCA or second sourcing from Cedar. R&H has already expressed their interest in buying Cedar's DCA.

3. The demand for DCA throughout the world is high. In addition to its role as the major ingredient for Propanil, DCA is a key ingredient in the production of DCPI which is an intermediate in the production of various other herbicides. About 80% of Bayer's and Rhone Poulenc's DCA production is for DCPI (primarily in Europe) and therefore Bayer and Rhone Poulenc are not threats to compete in DCA markets that Cedar will enter. DuPont and Stavely both sell the majority of their DCA to a wide range of Propanil producers around the world. Considering the competitive environment in which each DCA producer has relatively distinct markets, operating rates are high even with new capacity and no single producer can significantly increase its volume by cutting prices - Cedar is fairly certain that DCA prices will at least maintain their current levels and are likely to trend upward.

Cedar has already received indications of interest from several purchasers of DCA. It is expected that Cedar will take over several accounts that have previously been tolled through DuPont and sold by Monsanto. Monsanto has been assisting in establishing Cedar's relationship with various purchasers since Cedar will be sourcing Orthodichlorobenzene (ODCB) through Monsanto for the production of DCA (see section III). Many companies that use DCA in their production processes, particularly in Central America, have been eager to find a second supplier since supply conditions have been tight and Dupont has been unpredictable as the sole U.S. producer of DCA. Cedar is confident it will sell at least three million pounds of DCA in the merchant market starting in 1992.

## III. PRODUCTION

Cedar was recently given the opportunity to become a producer of DCA, when DuPont decided not to renew their ODCB/DCA toll agreement with Monsanto. Monsanto produces ODCB as a byproduct in the manufacture of Lasso, an important Monsanto product line. ODCB is the key raw material in the production of DCA. With surplus ODCB of which they would like to dispose, Monsanto was eager to entice Cedar to produce DCA . Consequently Monsanto has agreed to an arrangement that makes Cedar's entry into the business relatively easy and its operation favorable to Cedar. The key elements of the Monsanto/Cedar relationship are as follows:

- Monsanto will provide Cedar with used DCA production equipment at cost-to-dismantle plus freight

- Monsanto will license proven DCA technology to Cedar at no cost

- Cedar will purchase ODCB from Monsanto at prices about 20% below market (but varies with Benzene prices)

- While Monsanto is under long-term contract to supply Cedar with ODCB, Cedar is free to source from any supplier that could beat Monsanto's price.

The production of DCA from ODCB is a two-step process involving the nitration of ODCB to make dichloronitrobenzene (DCNB) followed by the reduction or hydrogeneation of DCNB to make DCA. The production of DCNB is a simple nitration in which Cedar has strong experience. Monsanto is providing the equipment and technology to complete the reduction of DCNB to DCA.

## IV. INVESTMENT REQUIREMENTS

Due to the favorable arrangement with Monsanto discussed in the previous section, Cedar requires a relatively modest investment to construct DCA production facilities with capacity for 11 million pounds. The following itemizes Cedar's investment in DCA production.

A. DCNB/DCA units

| | | |
|---|---|---|
| Demolition | 200 | |
| Structural | 350 | |
| Equipment | 1,030 | |
| Equipment Installation | 95 | |
| Piping | 579 | 2,254 |
| Instrument and Controls | 360 | |
| Electrical | 170 | |
| Insulation | 250 | |
| Concrete | 70 | |
| Painting | 55 | 905 |
| Freight | 55 | |
| Engineering | 500 | |
| Equipment Repair | 180 | |
| Crane Rental | 50 | |
| Waste Handling | 140 | 925 |
| Equipment Relocation | 175 | |
| Sub-Total | $4,259 | |

B. Auxiliary and Support Facilities

| | |
|---|---|
| DCA Storage (liquid) | 225 |
| Propanil Warehousing | 190 |
| Laboratory (addition) | 200 |
| Administrative Offices | 185 |
| | 800 |

| | |
|---|---|
| C. Interest during Construction | 275 |
| D. Contingency | 666 |
| Total Investment | 6,000 |

The $6 million is anticipated to be expended in 1990 as follows:

| | |
|---|---|
| First Quarter | $ 2,700,000 |
| Second Quarter | 1,600,000 |
| Third Quarter | 1,200,000 |
| Fourth Quarter | 500,000 |
| Total | $ 6,000,000 |

## V. PROJECT ECONOMICS

### A. FINANCING REQUIRED

Cedar will need a $6 million loan to build the DCA production facilities and commence operations. Considering the construction lead time, commencement of operation in 1991 and the strategic significance to Cedar's propanil business, we suggest the debt be structured as interest only through December 31, 199[illegible] and principal amortization of $1.5 million per year in each of the next four years as shown in the projections that follow. This structure will allow Cedar the operating flexibility to fully support the integrated DCA/Propanil business with a long-term perspective on marketing and pricing. Further, this structure will allow this financing to be arranged as an amendment to the existing Cedar Term Loan with a maturity consistent with the original loan.

## B) PROJECTIONS

DCA PROJECT
CASH FLOW PROJECTIONS
(DOLLARS IN THOUSANDS)

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| SALES: | | | | | | | | | | |
| PROPANIL | | 6,284 | 6,786 | 7,319 | 7,612 | 7,916 | 8,233 | 8,562 | 8,905 | 9,261 |
| MERCHANT DCA | | 0 | 4,586 | 4,770 | 4,961 | 5,159 | 5,365 | 5,580 | 5,803 | 6,035 |
| TOTAL DCA SALES | | 6,284 | 11,373 | 12,089 | 12,573 | 13,076 | 13,599 | 14,143 | 14,708 | 15,297 |
| COST OF GOODS SOLD: | | | | | | | | | | |
| ODCB | | 1,541 | 2,881 | 3,061 | 3,183 | 3,311 | 3,443 | 3,581 | 3,724 | 3,873 |
| OTHER RAW MATERIALS | | 1,067 | 1,995 | 2,119 | 2,204 | 2,292 | 2,384 | 2,479 | 2,578 | 2,681 |
| WASTE COST | | 1,304 | 2,438 | 2,590 | 2,693 | 2,801 | 2,913 | 3,030 | 3,151 | 3,277 |
| OTHER DIRECT COSTS | | 198 | 369 | 392 | 408 | 424 | 441 | 459 | 477 | 497 |
| TOTAL COST OF GOODS | | 4,110 | 7,684 | 8,162 | 8,488 | 8,828 | 9,181 | 9,548 | 9,930 | 10,328 |
| GROSS PROFIT | | 2,174 | 3,689 | 3,927 | 4,084 | 4,248 | 4,417 | 4,594 | 4,778 | 4,969 |
| SG&A EXPENSE: | | | | | | | | | | |
| WAGES AND SALARIES | | 300 | 312 | 324 | 337 | 351 | 365 | 380 | 395 | 411 |
| PLANT OVERHEAD | | 180 | 187 | 195 | 202 | 211 | 219 | 228 | 237 | 246 |
| DEPRECIATION | | 857 | 857 | 857 | 857 | 857 | 857 | 857 | 0 | 0 |
| TOTAL SG&A | | 1,337 | 1,356 | 1,376 | 1,397 | 1,419 | 1,441 | 1,464 | 632 | 657 |
| OPERATING PROFIT (EBIT) | | 836 | 2,333 | 2,551 | 2,687 | 2,829 | 2,976 | 3,130 | 4,146 | 4,312 |
| LESS INTEREST EXP @ | 11.25% | | | | | | | | | |
| TERM LOAN | | 675 | 591 | 422 | 253 | 84 | 0 | 0 | 0 | 0 |
| WORKING CAPITAL | | 106 | 192 | 204 | 212 | 221 | 229 | 239 | 248 | 258 |
| TAXABLE INCOME | | 55 | 1,550 | 1,925 | 2,222 | 2,524 | 2,747 | 2,891 | 3,898 | 4,054 |
| INCOME TAXES @ | 35% | 19 | 543 | 674 | 778 | 883 | 961 | 1,012 | 1,364 | 1,419 |
| NET INCOME | | 36 | 1,008 | 1,251 | 1,444 | 1,640 | 1,785 | 1,879 | 2,534 | 2,635 |
| DEPRECIATION | | 857 | 857 | 857 | 857 | 857 | 857 | 857 | 0 | 0 |
| CAPITAL EXPEND. | (6,000) | | | | | | | | | |
| CASH FLOW | (6,000) | 893 | 1,865 | 2,108 | 2,301 | 2,498 | 2,643 | 2,736 | 2,534 | 2,635 |
| CUMULATIVE CASH FLOW | (6,000) | (5,107) | (3,242) | (1,134) | 1,168 | 3,665 | 6,308 | 9,044 | 11,578 | 14,213 |
| TERM LOAN SCHEDULE: | | | | | | | | | | |
| OPENING BALANCE | 0 | 6,000 | 6,000 | 4,500 | 3,000 | 1,500 | 0 | 0 | 0 | 0 |
| REPAYMENTS | 0 | 0 | (1,500) | (1,500) | (1,500) | (1,500) | 0 | 0 | 0 | 0 |
| CLOSING BALANCE | 6,000 | 6,000 | 4,500 | 3,000 | 1,500 | 0 | 0 | 0 | 0 | 0 |

ASSUMPTIONS:

1) DCA VOLUME IS PROJECTED AS FOLLOWS (IN MILLIONS OF POUNDS):

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| PROPANIL SALES | 5.2 | 5.2 | 5.4 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 | 5.6 |
| DCA FOR PROPANIL | 4.0 | 4.0 | 4.1 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 | 4.3 |
| MERCHANT DCA SALES * | | 0.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |

* MERCHANT DCA SALES MAY COMMENCE IN 1991 DEPENDING ON WHEN CAPACITY IS AVAILABLE.

2) DCA PRICES ARE SET AS FOLLOWS:
INTERNAL TRANSFER PRICES ARE SET BASED ON DUPONT'S PRICE TO CEDAR (INCLUDING FREIGHT) OF: $1.59
MERCHANT DCA PRICES REFLECT MARKET PRICES LESS THE COST OF TERMS TO CERTAIN CUSTOMERS: $1.47

3) ALL COSTS OF GOODS SOLD AND ADMINISTRATIVE EXPENSES ARE BASED ON PREVAILING MARKET RATES AND ACTUAL EXPERIENCE OF CEDAR AND MONSANTO. 1991 ODCB COSTS ARE ESTIMATED TO BE $.39, OTHER RAW MATERIAL $.27, WASTE COST $.33, AND OTHER DIRECT COSTS $.05 PER POUND OF DCA PRODUCED.

4) REVENUE AND EXPENSES ARE SUBJECT TO INFLATION OF: 4%

5) TERM LOAN IS INTEREST ONLY AT PRIME PLUS 1.25% THROUGH 12/31/91 AND AMORTIZES $1.5 MILLION PER YEAR FOR THE NEXT 4 YEARS. INTEREST IS CALCULATED ON AVERAGE YEARLY BALANCE. WORKING CAPITAL NEEDS ARE ASSUMED TO BE 15% OF SALES.

6) ASSUMING $6MM INVESTMENT IN 1990 AND TERMINAL VALUE IN YEAR 2000 = 5 TIMES 1999 CASH FLOW:
NPV @ 14% = $6,887 ; IRR = 33%

CC: Charlie
Neil
Tom
Ken
Joe

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

May 17, 1989

Mr. Dana G. Devereux
National Sales Manager -
Process Chemicals
Monsanto Chemical Company
800 North Lindbergh Blvd.
St. Louis, Missouri 63167

Dear Mr. Devereux:

Reference is made to my letter to you of May 3, 1989, wherein I requested delivery of documents comprising Monsanto's technology package relative to the manufacture of dichloroaniline ("DCA"), which documents would be used by Cedar solely for the purpose of preparing a capital and operating budget, all in accordance with my letter to you, and the terms of the Secrecy Agreement between Cedar and Monsanto.

At your request, this letter will also serve as an expression of intent on the part of Cedar to enter into agreements with Monsanto, substantially in accordance with the provisions described hereinbelow, subject only to management approval of the capital budget for the project and execution of the definitive agreements referred to hereinbelow:

1. Equipment Purchase Agreement - Monsanto would sell and deliver to Cedar and Cedar would purchase and accept delivery from Monsanto, fob Monsanto Luling Plant, on a "as is, where is" basis, all equipment formerly used by Monsanto for production of DCA at its Luling Plant, which equipment we understand to have been capable of producing 11,000,000 pounds of DCA annually. It is understood that the purchase price for the equipment will not exceed the estimated out-of-pocket cost incurred by Monsanto in dismantling and removing the equipment incident to its delivery to Cedar at the Luling Plant. It is understood that Monsanto will only warrant title to the equipment and that it will make no representations or warranties regarding its condition or suitability for manufacture of DCA after it has been removed and reinstalled at Cedar's West Helena Plant. Cedar will only ask Monsanto to disclose any known defects and to identify any products other than DCA which have been produced in the equipment.

2. ODCB - Cedar would enter into a long term (minimum 5 years) Purchase Agreement with Monsanto whereby Monsanto would sell to Cedar and Cedar would purchase from Monsanto a minimum of 3,000,000 pounds of ODCB annually (up to 5,500,000 pounds at Cedar's option) at a price estimated at 36¢ per pound fob Cedar's West Helena Plant, based on existing market conditions. It is recognized that the agreement will need to include a formula for escalating or de-escalating the purchase price in a manner that will be acceptable to both Cedar and Monsanto. The agreement would become effective on the date that Cedar's DCA manufacturing facility, to be installed at Cedar's West Helena Plant using equipment purchased from Monsanto as aforesaid, has been completed and successfully started up.

3. DCA Technology License/Technical Assistance - Monsanto would grant to Cedar a non-exclusive royalty free license to use and practice Monsanto's methods and technology with respect to the manufacture of DCA. Monsanto would also make experienced and qualified personnel available to Cedar for the purpose of providing consultative services in connection with the construction and start-up of Cedar's DCA manufacturing facility contemplated herein.

In order for us to present this project to Cedar's management for approval at the earliest possible date, please make arrangements to deliver the technology documents referred to above to us as promptly as possible.

Sincerely yours,

William J. Eissler, Jr.
William J. Eissler, Jr.
Vice President and General
Manager - Organic Chemicals

WJE:jw

Enclosure

cc:
Mr. James C. Roder (Monsanto)
Mr. N. D. Morgan, Jr.
Mr. Geoffrey L. Pratt
Mr. John Miles

E. I. DU PONT DE NEMOURS & CO. (INC.)
CHEMICALS AND PIGMENTS DEPARTMENT
WILMINGTON, DELAWARE 19898 U.S.A.

INVOICE NO. L33 0436994
PAGE NO. 1
901-767-6203
INVOICE DATE 04/11/89
PAYMENT TERMS N 30

CUSTOMER ORDER NO. 04-36403
DU PONT ORDER NO. BXP M 14629 A43

SOLD TO
ROHM & HAAS CO
P O BOX 591
KNOXVILLE, TN 37901

SID NO. BXPM14629A43

ACCOUNT NO. 7682340

SHIP TO
CEDAR CHEMICAL CO
EAGLE RIVER CHEMICAL DIV
W HELENA, AR 72390

FREIGHT TERMS PREPAID
VIA: D S I TRANSPORT INC

DATE SHIPPED 04/11/89
SHIPPING WEIGHT 43580

SHIPPING TERMS
FOB SHIP POINT
DEEPWATER NJ
SHIP FROM: DEEPWATER NJ

| QUANTITY | UNIT | PRODUCT AND DESCRIPTION | UNIT PRICE | AMOUNT |
|---|---|---|---|---|
| 43580.00 | LB | 1 TKT 1081<br>3,4-DICHLOROANILINE TECH<br>VEH NO: 6878 | 0.75200 | 32772.16 |
| | | PLUS FREIGHT | 7.59000 | 3307.72 |
| LOT 437 | | | | |

IF ANY PROBLEM REGARDING THIS INVOICE, PLEASE CALL ROSE ANN HOOVER TOLL-FREE AT 1-800-441-9442

Buyer's acceptance of the goods covered by this invoice shall constitute acceptance by the buyer of all terms and conditions of sale stated above and on the reverse side hereof.

TOTAL 36079.88

CH-3076 REV.9/86

PLEASE SEND REMITTANCE IN U.S. DOLLARS WITH INVOICE NO.(S) AND ACCOUNT NO. TO:
DUPONT COMPANY
P.O.BOX 65112,CHARLOTTE,NC 28265
D-U-N-S 00-495-9458

CC: Tom Charlie
Ken Neil
Joe
[illegible]

DRAFT 3/23/89

[CEDAR LETTERHEAD]

March , 1989

Monsanto Company
800 North Lindbergh Blvd.
St. Louis, Missouri 63167

Attn: ____________________

Dear ____________:

This letter will serve as an expression of intent of Cedar Chemical Corporation ("Cedar") and Monsanto Company ("Monsanto") with regard to the project generally described herein (the "Project"). We acknowledge that the Project is subject to preparation, review and final management approval by our respective companies of the definitive agreements referred hereinbelow:

1. Equipment Purchase Agreement - Monsanto would sell and deliver to Cedar and Cedar would purchase and accept delivery from Monsanto, fob Monsanto Luling Plant, on a "as is, where is" basis, all equipment formerly used by Monsanto for production of dichloroaniline ("DCA") at its Luling Plant, which equipment we understand to have been capable of producing 11,000,000 pounds of DCA annually. It is understood that the purchase price for the equipment will not exceed the estimated out-of-pocket cost incurred by Monsanto in dismantling and removing the equipment incident to its delivery to Cedar at the Luling Plant. It is understood that Monsanto will only warrant title to the equipment and that it will make no representations or warranties regarding its condition or suitability for manufacture of DCA. Cedar will only ask Monsanto to disclose any known defects and to disclose any products other than DCA which have been produced in the equipment.

2. ODCB - Cedar would enter into a long term (minimum 5 years) Purchase Agreement with Monsanto whereby Monsanto would sell to Cedar and Cedar would purchase from Monsanto a minimum of 3,000,000 pounds of ODCB annually, up to 5,500,000 pounds at Cedar's option, at a price estimated at 36¢ per pound (based on current market conditions) fob Cedar's West Helena Plant. It is recognized that the agreement will need to include a formula for escalating or de-escalating the purchase price in a manner that will be acceptable to both Cedar and Monsanto. The agreement would become effective on the date that Cedar's DCA manufacturing facility, to be installed at Cedar's West Helena Plant using equipment purchased from Monsanto as aforesaid, has been completed and successfully started up.

3. DCA - Cedar would enter into a sales agreement with Monsanto whereby it would sell to Monsanto and Monsanto would purchase from Cedar approximately 800,000 pounds of DCA annually. The term of the DCA Sales Agreement would be identical to the term of the ODCB Purchase Agreement. The DCA price will be determined based on a mutually acceptable formula which will include as a principal factor the price which Cedar shall be obligated to pay Monsanto for ODCB purchased from it.

4. PCA/PCNB - During the same term as the ODCB and DCA Agreements referred to above, Cedar would sell to Monsanto and Monsanto would purchase approximately 1,500,000 pounds of PCA annually, and Monsanto would sell to Cedar and Cedar would purchase from Monsanto sufficient quantities of PCNB as shall be required by Cedar to produce the above quantity of PCA. The purchase and sale prices for PCA and PCNB, respectively, would be established with reference to mutually acceptable formulas intended to generate a reasonable operating profit for each party.

5. DCA Technology License/Technical Assistance - Monsanto would grant to Cedar an exclusive royalty free license to use and practice Monsanto's methods and technology with respect to the manufacture of DCA. Monsanto would also make experienced and qualified personnel available to Cedar for the purpose of providing consultative services in connection with the construction and start-up of Cedar's DCA manufacturing facility contemplated herein.

It is understood that this letter is only an expression of present intent of the parties with regard to the Project, and that the parties' respective rights and obligations shall be binding only in accordance with the terms and conditions stated in definitive agreements when and as approved and executed. By executing this letter of intent, each party agrees that it will not, for a period ending ninety days following the date hereof, disclose the Project to any third party, nor enter into any commitments with third parties which would effectively prevent or impair the ability of such party to enter into and consummate the definitive agreements referred to above. During said ninety-day period, Cedar and Monsanto shall make their best respective good faith efforts to negotiate and enter into the definitive agreements described above.

If you are in agreement with the foregoing, please sign and return the enclosed copy of this letter to me.

Very truly yours,

William J. Eissler, Jr.
Vice President and General Manager
Organic Chemicals

WJE:jw

AGREED:

MONSANTO COMPANY

By: ______________________________

cc JOHN MILES
G. PRATT
B. ISSLER

DC

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | Cedar - West Helena | | | | | | | |
| 2 | DCA Production Cost & Revenue | | | | | | | |
| 3 | As of 3/1/89 | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |
| 6 | Production - (Nitration-Reduction-Distillation) | | | | | | | |
| 7 | | | | | | | | |
| 8 | Raw Materials: | | | Usage Lb/Lb | | Cost /lb | | Total Cost /lb |
| 9 | ODCB | | | 1.099 | | 0.400 | | 0.4396 |
| 10 | 30% Oleum | | | 0.793 | | 0.083 | | 0.0658 |
| 11 | 98% HNO3 | | | 0.486 | | 0.144 | | 0.0700 |
| 12 | 1% Pt/C | | | 0.000557 | | 57.550 | | 0.0321 |
| 13 | H2 | | | 0.0449 | | 1.780 | | 0.0799 |
| 14 | Na2CO3 | | | 0.0185 | | 0.200 | | 0.0037 |
| 15 | Lime | | | 0.026 | | 0.050 | | 0.0013 |
| 16 | | | | | | | | |
| 17 | Total Raw Materials Cost | | | | | | | 0.6924 |
| 18 | | | | | | | | |
| 19 | | | | | | | | |
| 20 | Waste Treatment Cost | | | | | | | |
| 21 | Spent Acid | | | 1.009 | | 0.090 | | 0.0908 |
| 22 | Credit (SO3 Content as | | | | | | | |
| 23 | 30% Oleum) | | | -0.759 | | 0.043 | | -0.0326 |
| 24 | | | | | | | | 0.0582 |
| 25 | Aqueous for Diposal | | | | | | | |
| 26 | a. nitration washes | | | 0.096 | | | | |
| 27 | b. red'n aqueous | | | 0.335 | | | | |
| 28 | c. dehydration | | | 0.019 | | | | |
| 29 | | | | 0.450 | | 0.050 | | 0.0225 |
| 30 | | | | | | | | |
| 31 | Organics for incineration | | | | | | | |
| 32 | a. heads out | | | 0.107 | | | | |
| 33 | b. jet losses | | | 0.016 | | | | |
| 34 | c. bottoms | | | 0.095 | | | | |
| 35 | | | | 0.218 | | 1.000 | | 0.2180 |
| 36 | | | | | | | | |
| 37 | Total Waste Cost | | | | | | | 0.2987 |
| 38 | | | | | | | | |
| 39 | Production Cost: (Based on 7,000,000lbs production) | | | | | | | |
| 40 | Direct | | | | | | | 0.0400 |
| 41 | Fixed | | | | | | | 0.1350 |
| 42 | Plant Overhead | | | | | | | 0.0150 |
| 43 | Admin | | | | | | | 0.0200 |
| 44 | Depr ($3,000,000/10yrs=$300,000/7,000,000lbs=.0429) | | | | | | | 0.0429 |
| 45 | | | | | | | | |
| 46 | Total Production Cost | | | | | | | 0.2529 |
| 48 | Total Cost to produce DCA | | | | | | | 1.2440 |

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

REPLY TO: P. O. BOX 2749
WEST HELENA, AR 72390
(501) 572-3701

DATE: February 24, 1989

TO: John Miles

FROM: Tom Lodice

CC: Bill Eissler
Geoff Pratt
Willard Brown
Bill Gastrock
Neil Robbins
Charlie Parker
Joe Porter
Ken Howard

DCA/DCNB

Preliminary Project Capital Cost Analysis

SCOPE

1. The DCA/DCNB process would be installed in the ICI unit using some existing equipment, equipment from Monsanto, and some purchased equipment. Cedar's DCNB process would be used along with Monsanto's DCA process.

The ICI unit is the best choice for this project for the following reasons:

A. The ICI and Diphone units are the only ones large enough to hold all of the equipment and it would cost more to build a new unit since the foundation, steel, electrical system, and utility piping already exists in these units.

B. All of the piping in the ICI unit must be stripped out anyway, since it is in extremely poor condition and was installed for only one product.

C. By using the ICI unit, we will be able to combine DCA and Propanil production in one area and have an opportunity to minimize operating costs. Also, we can minimize freeze-up and downtime problems which would occur if we had to transfer the DCA over long distances.

2. We would only remove the following from Monsanto's plant:
   A. All available equipment in usable condition.
   B. All stainless steel piping larger than 4".
   C. All usable stainless steel valves.
   D. All Hastelloy piping and valves.
   E. All motor starters.
   F. We would only remove the piping and steel necessary for equipment removal. (We do not propose to demolish the Monsanto facility).

COST

The budget capital cost for this project is estimated to be $2.5 million as detailed on the following pages. The estimate is accurate to within 25% at this point, however, the project must be further defined before a more accurate estimate can be made. No costs were included for PCA.

TIMING

The total project will require approximately eight months to complete from the beginning of construction (demolition) until start-up.

COMMENTS

The following items are areas of concern at present:

1. We must obtain more detailed written process and equipment information from Monsanto in order to fully develop a piping and instrumentation diagram and more accurately assess the condition of Monsanto's equipment.

2. We must analyse the waste generation, treatment and disposal from the process in greater detail and in conjunction with Monsanto to develop a good, cost effective plan.

3. We need PCA information from Monsanto as soon as possible in order to develop impact on plant construction and operating costs.

3.We must get Monsanto's commitment to our project schedule so that the timing requirements on this project can be met.

Tom Lodice

DCNB/DCA CAPITAL COST ESTIMATE 2/13/89

| | ITEM | EQUIP | MAT'L | LABOR | TOTAL |
|---|---|---|---|---|---|
| I. | DEMOLITION | | 12,000 | 80,000 | 92,000 |
| II. | STRUCTURAL | | 40,000 | 60,000 | 100,000 |
| III. | EQUIPMENT | 390,000 | | | 390,000 |
| IV. | EQUIP. INSTALLATION | | 35,000 | 60,000 | 95,000 |
| V. | PIPING | | 270,000 | 230,000 | 500,000 |
| VI. | INSTR. & CONTROLS | | 105,000 | 85,000 | 190,000 |
| VII. | ELECTRICAL | | 60,000 | 40,000 | 100,000 |
| VIII. | INSULATION | | 70,000 | 120,000 | 190,000 |
| IX. | CONCRETE | | 15,000 | 30,000 | 45,000 |
| X. | PAINTING | | 10,000 | 30,000 | 40,000 |
| XI. | FREIGHT | | | 40,000 | 40,000 |
| XII. | ENGINEERING | | | 40,000 | 40,000 |
| XIII. | EQUIP. RELOCATION | | 25,000 | 35,000 | 60,000 |
| XIV. | EQUIP. REPAIR | | 60,000 | 50,000 | 110,000 |
| XV. | CRANE RENTAL | 45,000 | | | 45,000 |
| XVI. | WASTE HANDLING | 50,000 | 20,000 | 25,000 | 95,000 |
| | SUB-TOTAL | 485,000 | 722,000 | 925,000 | 2,132,000 |
| | CONTINGENCY (15%) | 72,750 | 108,300 | 138,750 | 319,800 |
| | TOTAL | 557,750 | 830,300 | 1,063,750 | 2,451,800 |
| | | | | | $\pm$25% |

DCNB EQUIPMENT LIST 2/9/89

| ITEM | DESCRIPTION | MAT'L | SIZE | STATUS | COST |
|---|---|---|---|---|---|
| B-D207 | Scrubber Blower | FRP | | E | |
| C-D207 | Scrubber Column | FRP | 18"x15' | E | |
| C-D603 | Emer. Vent Tank Scrubber | CS | | N | 12,000 |
| E-D101 | Circulation Cooler | 316L SS | 1320 SQ FT | E | |
| E-D302 | Mixed Acid Cooler | 316 SS | | N | 8,000 |
| P-D101A | Circulation Pump | 316 SS | 300 GPM | N | 6,000 |
| P-D101B | Circulation Pump | 316 SS | 300 GPM | N | 6,000 |
| P-D201 | ODCB Pump | DI | 100 GPM | N | 4,000 |
| P-D202 | Nitric Acid Pump | SS | | N | 4,000 |
| P-D203 | Oleum Pump | DI | | N | 3,000 |
| P-D204 | Spent Acid Pump | 316 SS | | N | 4,000 |
| P-D205 | Wastewater Pump | DI | | E | |
| P-D206 | Caustic Pump | DI | | E | |
| P-D207 | Scrubber Pump | 316 SS | | E | |
| P-D301 | Nitric Charge Pump | SS | | N | 3,000 |
| P-D302 | Mixed Acid Chg Pump | 316 SS | | N | 3,000 |
| P-D303 | V-D303 Pump | 316 SS | | N | 3,000 |
| P-D304 | V-D304 Pump | 316 SS | | N | 4,000 |
| R-D101 | Nitration Reactor | GL/Stl | 4,000 Gal | N | 40,000 |
| R-D102 | Wash Vessel | GL/Stl | 3,000 Gal | E | |
| T-D201 | ODCB Tank | CS | 20,000 Gal | N | 15,000 |
| T-D202 | Nitric Acid Tank | Alum. | 20,000 Gal | E | |
| T-D203 | Oleum Tank | CS | 15,000 Gal | E | |
| T-D204 | Spent Acid Tank | 316 SS | 15,000 Gal | N | 20,000 |
| T-D205 | Wastewater Tank | CS | 20,000 Gal | E | |
| T-D206 | Caustic Tank | CS | 20,000 Gal | E | |
| T-D207 | Scrubber Tank | FRP | 6,000 Gal | E | |
| V-D301 | Nitric Charge Vessel | 316 SS | 600 Gal | E | |
| V-D302 | Mixed Acid Chg Vess | GL/Stl | 1500 Gal | E | |
| V-D303 | Spent Acid Hold | 316 SS | 3,000 Gal | E | |
| V-D304 | Wastewater Hold | 316 SS | 2,000 Gal | E | |
| V-D305 | DCNB Hold Vessel | CS | 6,000 Gal | N | 10,000 |
| | TOTAL | | | | $145,000 |

DCA EQUIPMENT LIST 2/9/89

| ITEM | DESCRIPTION | MAT'L | SIZE | STATUS | COST |
|---|---|---|---|---|---|
| B-D304 | Lime Hopper Exhaust Fan | CS | 1475 CFM | N | 2,000 |
| C-D105 | Distillation Column | 316 SS | 5' x 60' | M | 28,000 |
| C-D603 | Emer. Vent Tank Scrubber | CS | | N | 12,000 |
| C-D605 | Emer. Scrubber-Still Pot | CS | | M | |
| E-D103 | Column Overhead Condenser | 316 SS | 569 Ft2 | M | |
| F-D101 | Autoclave Charge Line Filter | CS | | N | 3,000 |
| F-D102A | Catalyst Filter-North | 316 SS | | N | 4,000 |
| F-D102B | Catalyst Filter-South | 316 SS | | N | 4,000 |
| H-D501 | Autoclave Cooler | | 7MM BTUH | M | |
| H-D502 | Tempered Water Cooler | | 3MM BTUH | MR | |
| H-D503 | Hot Water Heater | GL/Stl | | N | 1,000 |
| H-D504 | Hot Oil Heater | | 8MM BTUH | N | 50,000 |
| H-D505 | Oil Cooler | | | N | 25,000 |
| P-D104 | Separator Pump | 316 SS | 75 GPM | N | 4,000 |
| P-D105 | Still Pot Bottoms Pump | 316SS | 50 GPM | N | 4,000 |
| P-D106 | Column Reflux Pump | 316 SS | 25 GPM | N | 3,000 |
| P-D106A | Column Reflux Pump - Spare | 316 SS | 25 GPM | N | 3,000 |
| P-D208 | Crude Storage Pump | 316SS | 100 GPM | N | 4,000 |
| P-D209 | Product Storage Tank Pump | 316 SS | 100 GPM | N | 4,000 |
| P-D305 | DCNB Pump | 316 SS | | N | 4,000 |
| P-D307 | Soda Ash Pump | DI | 20 GPM | N | 2,000 |
| P-D313 | Product Transfer Pump | 316 SS | 50 GPM | N | 3,000 |
| P-D501 | Autoclave C. W. Pump | DI | 280 GPM | M | |
| P-D501A | Autoclave C. W. Pump - Spare | DI | 280 GPM | N | 4,000 |
| P-D502 | Tempered Water Pump | DI | 350 GPM | M | |
| P-D503 | Hot Water Tank Pump | DI | | N | 2,000 |
| P-D504 | Hot Oil Pump | 316 SS | | N | 6,000 |
| P-D505 | Oil Cooler Pump | 316 SS | | N | 6,000 |
| P-D601 | Pit Pump | DI | | N | 3,000 |
| R-D103 | Autoclave | Hast. C276 | 1000 Gal | MR | |
| R-D104 | Water Separation Tank | GL/Stl | 1500 Gal | M | |
| R-D105 | Column Still Pot | 316L SS | 6300 Gal | MR | |
| T-D208 | Crude Storage Tank | 316SS | 12M Gal | M | |
| T-D209 | Refined DCA Storage Tank | Lined | 25M Gal | M | |

DCA EQUIPMENT LIST 2/9/89

| ITEM | DESCRIPTION | MAT'L | SIZE | STATUS | COST |
|---|---|---|---|---|---|
| V-D103 | Column Reflux Surge Tank | 316 SS | 75 Gal | M | |
| V-D306 | Catayst Mix Tank | CS | 50 Gal | N | 1,000 |
| V-D307 | Soda Ash Tank | 304SS | 100 Gal | N | 3,000 |
| V-D308 | Secondary Separator | CS | 950 Gal | N | 2,000 |
| V-D309 | Lime Hopper | 304SS | | N | 5,000 |
| V-D310 | Head Frac. Receiver | CS | 1250 Gal | M | |
| V-D311 | PCA Inter. Frac. Receiver | 316 SS | 500 Gal | M | |
| V-D312 | DCA Inter. Frac. Receiver | 316 SS | 2100 Gal | M | |
| V-D313 | Main Fraction Receiver | 316 SS | 3750 Gal | M | |
| V-D314 | Residue Hold Tank | CS | 5000 Gal | M | |
| V-D315 | DCA Head Tank | 316 SS | 10,000 Gal | M | |
| V-D501 | Water Tank Autoclave Cooler | CS | 1000 Gal | M | |
| V-D502 | Tempered Water Tank | CS | 1000 Gal | M | |
| V-D503 | Hot Water Tank | CS | 100 Gal | N | 1,000 |
| V-D601 | Emer. Pit - Still Pot | | | N | 10,000 |
| V-D602 | Knock-Out Tank | CS | 1250 Gal | M | |
| V-D603 | Autoclave Emer. Vent Tank | CS | 3000 Gal | N | 15,000 |
| V-D604 | Still Emer. Vent Catch Tank | CS | 125 Gal | M | |
| V-D605 | Still Pot Emer. K. O. Tank | CS | | N | 5,000 |
| VP-D401 | Vacuum System | | | N | 30,000 |
| | TOTAL | | | | $253,000 |

N = New

E = Existing

M = Monsanto

MR = Monsanto, requiring repairs

# MONSANTO DCA USAGE FACTORS

| RAW MATERIALS | 1979 | 1978 | 1977 |
|---|---|---|---|
| DCNB (Lb/cwt) | 150.526 | 156.138 | 154.88 |
| Pt Cat. (Lb/cwt) | 0.0704 | 0.0688 | 0.066 |
| Water (Lb/cwt) | 6.4793 | 5.5168 | 6.546 |
| **UTILITIES** | | | |
| 600# Steam (Mlb/cwt) | 0.6114 | 0.5738 | 0.3970 |
| 175# Steam (Mlb/cwt) | 0.7271 | NA | NA |
| Electricity (Kwh/cwt) | 0.2256 | NA | NA |
| Instr. Air (Mcf/cwt) | 0.3051 | 0.5264 | NA |
| CO2 (Lb/cwt) | 26.0228 | 34.1936 | 32.647 |
| N2 (Mcf/cwt) | 0.090 | 0.0552 | NA |
| Water (Mgal/cwt) | 0.062 | 0.0966 | 0.100 |

# MONSANTO DCA CYCLE TIMES

## AUTOCLAVE

| Function | Time(Hrs.) |
|---|---|
| Charging | 0.25 |
| Low Press. Rxn | 2.50 |
| High Press. Rxn | 1.00 |
| Transfer | 0.25 |
| Total | 4.00 |

## DISTILLATION

| Function | Time(Hrs.) |
|---|---|
| Charge, dehyd., reflux | 4 |
| Head Fraction | 13 |
| Intermed. Fraction | 7 |
| Main Fraction | 6 |
| Total | 30 |

## PRODUCTION RATE

On stream time = 90%

Mechanical downtime = 5%

Process downtime = 3%

Other downtime = 2%

On stream rate = 1343 lb/hr = 10,440,000 lbs/year

# MONSANTO DCNB

| | Typical Analysis |
|---|---|
| ODCB | 0.05% |
| 2,5/2,3-DCNB | 13.5% |
| 3,4-DCNB | 85.9% |
| Water | 0.01% |

| | Specifications |
|---|---|
| Low Boilers | 0.1% |
| 2,5-DCNB | 0.3% |
| 2,3-DCNB | 11.8% |
| 3,4-DCNB | 87.7% |
| Specific Grav. 35/15.5 C | 1.503-1.509 |
| Moisture | 0.1% Max. |
| Sulfur | 1 ppm max. |

.3,000,000 Capital 7,000,000 lbs

2-28-89 1.44 Dol. DCA COST

CEDAR NITRATION - REDUCTION - DISTILLATION

| RAW MATERIAL | USAGE (lb/lb DCA) | PRICE ($/lb) | COST CONTRIB ($/lb DCA) |
|---|---|---|---|
| ODCB | 1.099 | .40 | |
| 30% OLEUM | 0.793 | 0.083 | 0.066 |
| 98% $HNO_3$ | 0.486 | 0.144 | 0.070 |
| 1% Pt/C | 0.000557 | 57.55 | 0.032 |
| $H_2$ | 0.0449 | 1.78 | 0.080 |
| $Na_2CO_3$ | 0.0185 | 0.20 | 0.004 |
| LIME | 0.026 | 0.05 | 0.001 |
| | | TOTAL (minus ODCB) | 0.253 |
| | | | .440 |

| WASTE | PRODUCED (lb/lb DCA) | PRICE ($/lb) | COST ($/lb DCA) |
|---|---|---|---|
| 1- SPENT ACID | 1.009 | 0.05 +0.04 FRT | 0.091 |
| RETURN FOR INCINERATION | | | |
| CREDIT FOR $SO_3$ CONTENT AS 30% OLEUM | (0.759) | 0.043 | (0.033) |
| | | | 0.058 |
| 2- AQUEOUS FOR DISPOSAL | | | |
| a- NITRATION WASHES | 0.096 | | |
| b- REDN AQUEOUS | 0.335 | | |
| c- DEHYDRATION | 0.019 | | |
| | 0.450 | 0.05 | 0.023 |
| 3- ORGANICS FOR INCINERATION | | | |
| a- HEADS CUT | 0.107 | | |
| b- JET LOSSES | 0.016 | | |
| c- BOTTOMS | 0.095 | | |
| | .218 | 1.00 | 0.218 |
| | | Total waste | 0.299 |

1.235 .992 Cap .043 .20

2-28-89
1.44 DCA
COST

CEDAR NITRATION - SULFONATION - CEDAR REDUCTION

| RAW MATERIAL | USAGE (lb/lb DCA) | PRICE ($/lb) | COST CONTRIB ($/lb DCA) |
|---|---|---|---|
| ODCB | 1.108 | | |
| 30% OLEUM | 1.629 | 0.083 | 0.135 |
| 98% $HNO_3$ | 0.490 | 0.144 | 0.071 |
| 1% Pt/C | 0.00528 | 57.55 | 0.304 |
| $H_2$ | 0.041 | 1.78 | 0.073 |
| MORPHOLINE | 0.0018 | 1.00 | 0.002 |
| $NaHCO_3$ | 0.012 | 0.18 | 0.002 |
| | | TOTAL (minus ODCB) | 0.587 |

| WASTE | PRODUCED (lb/lb DCA) | PRICE ($/lb) | COST ($/lb DCA) |
|---|---|---|---|
| 1- SPENT ACID | | | |
| a- NITRATION | | | |
| INCINERATION | 1.017 | 0.05 + 0.04 FRT | 0.092 |
| CREDIT FOR $SO_3$ | (0.765) | 0.043 | (0.033) |
| b- SULFONATION | | | |
| INCINERATION | 1.310 | 0.05 + 0.04 FRT | 0.118 |
| CREDIT FOR $SO_3$ | (0.782) | 0.043 | (0.034) |
| | | | 0.143 |
| 2- AQUEOUS FOR DISPOSAL | | | |
| a- SULFONATION WASH | 0.026 | | |
| b- RED'N AQUEOUS | 0.337 | | |
| c- DEHYDRATION | 0.018 | | |
| | 0.381 | 0.05 | 0.019 |
| | | TOTAL WASTE | 0.162 |

SUBJECT: DCA Process Evaluation — DATE: Feb. 27, 1989

TO: Mr. J. Miles — FROM: K. J. Howard

Copies: R. Fairchild; W. Gastrock; T. Lodice; G. Pratt
J. Porter; N. Robbins; G. Satterfield

Monsanto has for years produced DCA by nitration of oDCB to DCNB, hydrogenation to DCA, and distillation to 98 % DCA. The product was used internally and sold. Their technology involved an acid-phase hydrogenation which they claim to be inherently safer than other methods practiced by their competitors. It also appears to use an extremely low amount of catalyst. Very little information on their nitration step was available. Two material balances were calculated, one based upon their DCNB and the second upon DCNB produced by Cedar. The material balances are attached to this memorandum. The following table summarizes the raw material usages and the wastes generated.

| | Pounds / pound of 98 % DCA | |
|---|---|---|
| RAW MATERIALS | MONSANTO | CEDAR |
| oDCB | 1.178 | 1.100 |
| H2SO4 ( 100 % ) | 1.165 | 0.847 (0.793 as 30%Oleum) |
| HNO3 ( 100 % ) | 0.529 | 0.477 |
| Hydrogen ( 100 % ) | 0.0662 | 0.045 (8SCF) |
| Catalyst (Gross Usage) | 0.000593 | 0.00045 |
| Soda Ash | 0.0358 | 0.0185 |
| Lime | 0.0276 | 0.0259 |
| WASTES | | |
| Spent Acid | (1.20 est) | 1.009 |
| DCNB Wash Water | ? | 0.0685 |
| DCNB Carbonate Wash | ? | 0.0266 |
| Autoclave Vent Organics | 0.0064 | 0 |
| DCA Carbonate Wash | 0.273 | 0.335 |
| Dehydration | 0.0197 | 0.194 |
| Vacuum Jet Organics | 0.0273 | 0.159 |
| Heads Cut | 0.150 | 0.107 |
| Bottoms | 0.104 | 0.095 |
| Scrubber Solution | 0 | 0.017 (2%H2SO4) |

COMMENTS:

The 'Adjusted DCA Material Balance' is the Monsanto process and material balance corrected for unstated losses such as the autoclave vent and the jet losses. The Monsanto usages of oDCB, H2SO4, HNO3, and Soda Ash given in a note from W. Gastrock, stated to be from G. Pratt. The Monsanto spent acid is estimated from sulfuric acid usage, water in the nitric acid, and water of reaction. The heads cuts and bottoms are the pure streams; in reallity some of the heads cut is used to dilute the bottoms to make it easier to pump and drum.

The Cedar process modification consists of using a higher quality DCNB as shown in W. Gastrock's report, followed by a soda ash wash, Monsanto hydrogenation using liquid hydrogen, and distillation. Obviously there would be almost no vent losses from the hydrogenation step when using pure hydrogen. This has a side effect which will have to be corrected; the volume in the hydrogenator will be about 50 gallons more than in the Monsanto case due to less vent losses. The next result is that this extra water shows up as more waste in the DCA carbonate wash. In both cases the dehydration condensate can be combined with the carbonate wash to significantly decrease the amount of organics lost. The vacuum jet organics will be a problem in either case. They are related to the amount of air leaks in the distillation system and any inerts generated by the distillation mass. They will occur regardless of the vacuum source. They MAY be easier to recover from a vacuum pump system. The reduction in heads cut is a direct result of the higher quality DCNB. High boilers generated during the distillation were assumed to be related entirely to time-temperature. This resulted in a small reduction in the amount of high boilers in the Cedar case due to the reduction in time necessary to distill the heads cut. The conversions and yields accross the hydrogenation step were assumed to be totally independent of the DCNB quality ( ie. pure 3,4-DCNB would still generate the same amount of aniline, monochloroaniline, trichloroaniline, tetrachloroazoxybenzene, and high boilers ). This may be a little harsh, but is probalby closer to the truth than assuming that the yield would be significantly improved using a better grade DCNB.

The catalyst usage is reported as a gross usage. Monsanto's figures indicate that as much as 75 % of the platinum value may be recoverable by the catalyst manufacturer.

# 'ADJUSTED' DCA MATERIAL BALANCE

| | STG. TANK VENT LOSSES | AUTOCLAVE CHARGE | HYDROGEN FEED | HYDROGEN VENTED | AUTOCLAVE TRANSFER TO SEPARATOR | VENT LOSS FROM SEP. | SODA ASH ADDED | FILTER CAKE | WATER LAYER TO DISPOSAL | FEED TO DISTILL. | FEED TO DISTILL X5.525 | DEHYD. | HEADS CUT | HEADS JET LOSS | INTERM JET LOSS | MAIN CUT | MAIN CUT JET LOSSES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $H_2O$ | | 12.5 | | 452 | 1210.76 | | 336 | 1.88 | 1440.63 | 108 | 596.7 | 581 | | | | 16 | |
| ODCB | | 44 | | 2.57 | 41.43 | 0.005 | | 0.056 | | 41.37 | 228.57 | 5.67 | 49 | 173.9 | | | |
| 2,3+25 DCNB | 0.013 | 1203 | | 2.65 | | | | | | | | | | | | | |
| 3,4-DCNB | 0.087 | 7661 | | 16.80 | | | | | | | | | | | | | |
| 1% Pt/C | | 3.5 | | | 3.5 | | | 3.1 | | 0.4 | 2.21 | | | | | | |
| ANILINE | | | | 0.28 | 21.70 | 0.002 | | 0.018 | 0.8 | 20.88 | 115.36 | 1.25 | 64 | 43.17 | | | |
| MONO Cl ANILINES | | | | 0.80 | 121.43 | 0.004 | | 0.136 | 1.2 | 120.09 | 663.50 | 2.74 | 509 | 85.16 | 0.35 | | |
| 2,3+25-DCA | | | | 3.08 | 884.17 | 0.013 | | 1.13 | 1.0 | 882.03 | 4873.22 | 11.47 | 4051 | 390.80 | 40.39 | 246 | 1.14 |
| 3,4-DCA | | | | 11.58 | 6007.54 | 0.043 | | 7.48 | 5.0 | 5995.02 | 33122.49 | 41.19 | 220 | 1.14 | 74.62 | 32116 | 79.52 |
| TCA's | | | | | 52.32 | | | 0.065 | | 52.26 | 288.74 | 0.44 | | | | 246 | 0.53 |
| TCAB's | | | | | 139 | | | 0.174 | | 138.83 | 767.04 | | | | | | |
| HIGH BOILERS | | | | | 64 | | | 0.081 | | 63.92 | 353.16 | | | | | | |
| HCl | | | | | 41.99 | | | | | | | | | | | | |
| NaCl | | | | | | | | 0.10 | 62.16 | 5.04 | 27.85 | | | | | | |
| LIME | | | | | | | | | | | 900 | | | | | | |
| $Na_2CO_3$ | | | | | | | 100 | | | | | | | | | | |
| $NaHCO_3$ | | | | | | | | 1.78 | 41.19 | 18.81 | 103.93 | | | | | | |
| $H_2$ | | | 389 | 112 | | | | | | | | | | | | | |
| $N_2$ | | | 1798 | 1798 | | | | | | | | | | | | | |
| 'ODCB' HEAVY | | | | | 50.97 | | | 0.063 | | 50.91 | 281.28 | | | | | | |
| UNKNOWN LOSSES | | | | | 72.43 | | | 0.092 | 52.43 | 19.91 | 110.00 | | | | | | |
| $CO_2$ | | | | | | | | | 9.16 | | | | | | | | |
| TOTAL | 0.100 | 8924 | 2187 | 2399.76 | 8711.24 | 0.067 | 436 | 16.155 | 1613.57 | 7517.47 | 42434.01 | 643.76 | 4893 | 694.17 | 115.36 | 32624 | 81.19 |

KJH
2-20-89

# 'ADJUSTED' DCA MATERIAL BALANCE

| | BOTTOMS | BOTMS + 100 GAL HEAD CUT | BTMS TRANSF VENT. | BTMS DRUMNG VENT |
|---|---|---|---|---|
| | | | | |
| $H_2O$ | | | | |
| ODCB | | 11 | 0.72 | 0.10 |
| 2,3+2,5-DCNB | | | | |
| 3,4-DCNB | | | | |
| 1% Pt/C | 2.21 | 2.21 | | |
| ANILINE | | 33 | 0.09 | 0.01 |
| MCl ANILINES | | 189 | 0.15 | 0.02 |
| 2,3+2,5-DCA | | 821 | 0.37 | 0.04 |
| 3,4-DCA | 490 | 546 | 0.15 | 0.01 |
| TCA's | 41 | 41 | 0.01 | |
| TCAB's | 767 | 767 | | |
| HIGH BOILERS | 757 | 757 | | |
| HCl | | | | |
| NaCl | 27.85 | 27.85 | | |
| LIME | 900 | 900 | | |
| $Na_2CO_3$ | | | | |
| $NaHCO_3$ | 103.93 | 103.93 | | |
| $H_2$ | | | | |
| $N_2$ | | | | |
| 'ODCB' HEAVY | 281.28 | 281.28 | | |
| UNKNOWN LOSSES | 12.26 | 12.26 | | |
| $CO_2$ | | | | |
| TOTAL | 3382.53 | 4492.53 | 1.49 | 0.18 |

KJH

2-20-89

2-21-89

# CEDAR DCA MTL BAL

| | OLEUM FEED | NITRIC ACID FEED TO MIXED ACID | MIXED ACID FEED | ODCB | NITRIC ACID TO NITRTR | DILUTN WATER TO NITRTR | WATER TO NITRTR | SPENT ACID TO STG. | CRUDE DCNB TO NEUTR. | WASH WATER TO STG. | 10% SODA ASH TO NEUTR. | CRUDE DCNB TO STG. | SPENT SODA ASH SOLN TO DISPOSAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $H_2O$ | | 77 | | | 106.5 | 1198.5 | 2428.5 | 2889 | 82.5 | 2395.5 | 450 | 70 | 462.5 | |
| $H_2SO_4$ | 10808.7 | | 11227.9 | | | 130.5 | | 16603.5 | 8.9 | 259.5 | | – | | |
| $SO_3$ | 4632.3 | | 4290.1 | | | | | | | | | | | |
| $HNO_3$ | | 3711 | 3711 | | 5574.5 | | | 58.5 | 0.03 | 0.9 | | – | | |
| ODCB | | | | 21306.5 | | | | | | | | | | |
| PDCB | | | | 106.5 | | | | | | | | | | |
| 2,3 & 2,5-DCNB | | | | | | 0.8 | | 9.0 | 2566.5 | 1.5 | | 2566.2 | 0.3 | |
| 3,4-DCNB | | | | | | 7.5 | | 88.5 | 24981 | 13.5 | | 24978.4 | 2.6 | |
| 1% Pt/C | | | | | | | | | | | | | | |
| ANILINE | | | | | | | | | | | | | | |
| MCl ANILINES | | | | | | | | | | | | | | |
| 2,3 & 2,5 DCA | | | | | | | | | | | | | | |
| 3,4-DCA | | | | | | | | | | | | | | |
| TCA's | | | | | | | | | | | | | | |
| TCAB's | | | | | | | | | | | | | | |
| HIGH BOILRS | | | | | | | | | | | | | | |
| HCl | | | | | | | | | | | | | | |
| NaCl | | | | | | | | | | | | | | |
| $Na_2CO_3$ | | | | | | | | | | | 50 | 3.8 | 25.4 | |
| $NaHCO_3$ | | | | | | | | | | | | 2.2 | 14.3 | |
| $CO_2$ | | | | | | | | | | | | | | |
| $H_2$ | | | | | | | | | | | | | | |
| 'ODCB' HVYS | | | | | | | | | | | | | | |
| UNKNOWN LOSSES | | | | | | | | | 54.0 | | | 54.0 | | |
| LIME | | | | | | | | | | | | | | |
| $Na_2SO_4$ | | | | | | | | | | | | 1.9 | 12.2 | |
| TOTAL | 15441 | 3788 | 19229 | 21413 | 5681 | 1337.3 | 2428.5 | 19648.5 | 27692.93 | 2670.9 | 500 | 27676.5 | 517.3 | KJH |
| | | | | | | | | | | | | | | |

2-21-89

# CEDAR DCA MTL BAL

| | AUTOCLVE CHARGE | HYDROGEN FEED | AUTOCLVE TRANSFER TO SEPARATOR | SODA ASH ADDED | FILTER CAKE | WATER LAYER TO DISPOSAL | FEED TO DISTILL. | FEED TO DISTILL x5.525 | DEHYD. | HEADS CUT | HEADS JET LOSSES | INTERIM CUT JET LOSS | MAIN CUT | MAIN CUT JET LOSS | BOTMS | BTMS + 100 BAL HEAD CUT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $H_2O$ | 26.1 | | 1693.1 | 336 | 1.9 | 1913.2 | 114 | 629.9 | 613.8 | | | | 16.1 | | | | |
| 2,3+2,5-DCNB | 827.4 | | | | | | | | | | | | | | | | |
| 3,4-DCNB | 8054.0 | | | | | | | | | | | | | | | | |
| 1% Pt/C | 3.5 | | | | 3.1 | | 0.4 | 2.21 | | | | | | | 2.21 | 2.21 | |
| ANILINE | | | 22.0 | | | 1.1 | 20.9 | 115.47 | 1.32 | 85.4 | 28.75 | | | | | 25.6 | |
| MCl ANILINES | | | 121.4 | | 0.1 | 1.6 | 119.7 | 661.34 | 2.89 | 601.7 | 56.4 | 0.35 | | | | 180.5 | |
| 2,3+2,5-DCA | | | 613.1 | | 0.8 | 1.3 | 611.0 | 3375.78 | 9.3 | 2858.0 | 265.8 | 40.39 | 261.7 | 1.22 | | 857.3 | |
| 3,4-DCA | | | 6341.1 | | 7.9 | 6.6 | 6326.6 | 34954.47 | 46.3 | 155.2 | 0.76 | 74.62 | 34176.6 | 84.77 | 468.0 | 514.6 | |
| TCA's | | | 52.3 | | | | 52.3 | 288.96 | 0.46 | | | | 261.7 | 0.56 | 26.24 | 26.24 | |
| TCAB's | | | 139 | | 0.2 | | 138.8 | 766.87 | | | | | | | 766.9 | 766.9 | |
| HIGH BOILERS | | | 64 | | | | 64 | 353.6 | | | | | | | 690.0 | 690.0 | |
| HCl | | | 40.9 | | | | - | | | | | | | | | | |
| NaCl | | | 1.8 | | 0.1 | 63.4 | 3.8 | 21.0 | | | | | | | 21.0 | 21.0 | |
| LIME | | | | | | | - | 900 | | | | | | | 900 | 900 | |
| $Na_2CO_3$ | 1.2 | | - | 100 | | | - | | | | | | | | | | |
| $NaHCO_3$ | 0.7 | | - | | 1.8 | 40.7 | 19.9 | 109.9 | | | | | | | 109.9 | 109.9 | |
| $CO_2$ | | | 0.9 | | | 10.1 | - | | | | | | | | | | |
| $H_2$ | | 282 | | | | | - | | | | | | | | | | |
| 'ODCB' HEAVY | | | 51.0 | | 0.1 | | 51.0 | 281.8 | | | | | | | 281.8 | 281.8 | |
| UNKNOWN LOSSES | 17.4 | | 89.8 | | 0.1 | 65.0 | 24.7 | 136.5 | | | | | | | 15.2 | 15.2 | |
| $Na_2SO_4$ | 0.6 | | 0.6 | | | 0.5 | 0.1 | 0.5 | | | | | | | 0.5 | 0.5 | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| TOTAL | 8930.9 | 282 | 9231 | 436 | 16.1 | 2103.5 | 7547.2 | 42598.3 | 674.07 | 3700.3 | 351.71 | 115.36 | 34716.1 | 86.55 | 3281.75 | 4391.75 | |
| | | | * 1.05 x MONSANTO | | | | | | | | | | | | | | KJH |

cc: Brown
Miles

cc: Tom
Ken
Neil
Charlie
Joe P.

**CEDAR CHEMICAL CORPORATION**

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

December 21, 1988

Mr. James Roder
Monsanto Chemical Company
800 N. Lindbergh Boulevard
St. Louis, MO 63167

Dear Jim:

We sincerely appreciate your hospitality during our recent visit to discuss our joint DCA project.

I would like to confirm the major points of agreement from our meeting:

1) Monsanto will make a decision regarding it's options for ODCB marketing at the end of the first quarter of 1989. We jointly need to develop the final data for Cedar's proposal by the early part of March, 1989, so that it can be included in Monsanto's consideration.

2) Cedar's proposal would be based upon the attached formula with the specific numbers being refined prior to the above noted deadline.

3) In order to aid Cedar in developing the capital cost for the project, Monsanto will arrange for a visit to it's Sauget plant by Cedar representatives to view the DCA plant, which is now idle. Monsanto will also provide Cedar with specifications for the major equipment items.

4) Monsanto will determine if it is willing to provide this equipment to Cedar as part of the joint project, and under what terms.

5) Monsanto will provide Cedar with an amendent to our current secrecy agreement to include technology on parachloroanaline with a view to including production of approximately 1.2 million pounds of PCA into our joint project.

6) Monsanto would provide minimum specifications for the 800,000 lbs. of DCA to be used for the production of TCC, so that Cedar can determine if it's technology can produce this quality DCA without distillation. Monsanto

will also supply proposed specifications on it's ODCB, both for the standard preferred quality and also the highest practical quality.

We would appreciate any comments that you have on the make-up of our proposed formula for adjusting ODCB price to Cedar. As we indicated, the figures used in the formula are our current estimates and are subject to reevaluation as our joint technical efforts proceed.

Monsanto indicated that one million pounds of ODCB would be available in 1989, beginning with the second quarter, and five million pounds in 1990. If we could reach agreement in principal at the end of the first quarter of 1989, the earliest we could expect production to begin would be in the last quarter of 1989. Thus it would seem that our consumption of ODCB in 1989 would be minimal, but we should be able to consume all of your available material from 1990 onwards.

We look forward to hearing from you on the plant visit and technology exchange, so that we can maintain the momentum of this project.

Sincerely,

Geoff L Pratt

Geoffrey L. Pratt
Director of Operations/
Custom Manufacturing

/kt

Attachments

## Base Price for ODCB:

A) Estimated Costs to Buy or Produce DCA

| | Per Pound DCA |
|---|---|
| Anticipated Cost to Buy DCA (Based on Actual, Jan.-Oct., 1988) | $1.34 |
| Other Raw Materials | .29 |
| Waste Disposal | .28 |
| Manufacturing | .23 |
| Capital Cost* | .20 |
| Subtotal | $1.00 |
| Available to Pay for ODCB | .34 |

B) Required ODCB Price $.309

(.34 ÷ 1.1 Pounds/Pound DCA)

* Capital Cost = $2 million ÷ 3 years ÷ 3.5 million lbs. (1989 SLS Propanil budget = 4,321,000 lbs., x .8 pounds DCA/lb. propanil)

CC: Charlie
Neil

**CEDAR INTERNAL CORRESPONDENCE**

DATE: 12/21/88

TO: John Miles

FROM: Geoffrey Pratt

CC: Joe Porter
Tom Lodice
Ken Howard
Bill Gastrock
Greg Satterfield

SUBJECT: DCA plant

There is an increasing possibility that we will have a long term agreement with Monsanto who will provide ODCB and possibly technology and equipment to produce DCA commencing late 1989, or early 1990.
In order for this to be possible, it is imperative that by the end of February, 1989, we confirm the technology and cost elements for the construction and operation of the plant. This will require that we select either the Cedar or Monsanto route, resolve waste disposal issues, and complete an appropation grade capital cost estimate. I realize that we already have a heavy workload, particularly if we are successful in signing the Grace contract in early 1989, however the Monsanto project offers the best possibility for obtaining our own production of DCA, and we must act accordingly.

Shortly after the holidays, we will meet to develop a program to complete the above work. Two things appear obvious at this point:

1) We will have to seek additional outside help for the engineering work, either on DCA or the Grace project.

2) Cost constraints require that we use as much existing, installed equipment as possible. We should, therefore, consider either the diphone or the ICI units for the nitration/sulphonation reactions.

We must maintain our activities confidential until the appropiate time, and so extreme caution must be exercised when contacting outside suppliers, etc.

GLP

**CEDAR INTERNAL CORRESPONDENCE**

DATE: December 14, 1988

TO: Geoff Pratt

FROM: Neil Robbins

CC: Charlie Parker
John Miles

SUBJECT: DCA Cost

DCA COST

| | Per Lb. Cost Actual | F.O.B. Price |
|---|---|---|
| 1982 | 1.27 | 1.36 |
| 1983 | 1.31 | 1.42 |
| 1984 | 1.22 | 1.41 |
| 1985 | 1.12 | 1.12 |
| 1986 | 1.12 | 1.12 |
| 1987 | 1.23 | 1.24 |
| 1988 | 1.32 | 1.34 |

DCA
CEDAR . WEST HELENA

12-13-88

| | PER lb COST ACTUAL | F.O.B. PRICE |
|---|---|---|
| 1982 | 1.27 | 1.36 |
| 1983 | 1.31 | 1.42 |
| 1984 | 1.22 | 1.41 |
| 1985 | 1.12 | 1.12 |
| 1986 | 1.12 | 1.12 |
| 1987 | 1.23 | 1.24 |
| 1988 | 1.32 | 1.34 |

cc: Tom Neil
Greg Richard
Joe

Organic Division Meeting 10/3/88

## Wham Strategy

(Miles) Flaker ----> Cost $150M CAR-Memphis 10/6/88

Target 300M gallon by April 1, 1989

Flake ----> Red Panther 5 M/day Wham Jan. 1, 1987 start

Flaker deliver 16 weeks February 1, 1989

(Miles) Rent Flaker 10/7/88

(Miles) Check molten Propanil -----> Red Panther this week 10/7/88

(Bernard Pratt) Contract Parameters Red Panther

(Parker) Toll Flake cost & logistics 10/14/88

## DCA Strategy

1) Lab work to determine DCNB purity by Cedar process (Gastrock)

2) ODCB meetings PPG 10/12/88 (Pratt, Parker, Whitsitt)
   Standard ? (Pratt)

3) Monsanto meeting ? (Pratt)

4) DCA users meeting: Guatemalans R & H (Keese)

Attendees:

| | |
|---|---|
| W. Brown | S. Bernard |
| C. Keese | W. Gastrock |
| J. Miles | J. Whitsitt |
| C. Parker | G. Pratt |

# CEDAR CHEMICAL CORPORATION

24th Floor • 5100 Poplar Avenue • Memphis, TN 38137 • 901-685-5348

REPLY TO: P. O. BOX 3
VICKSBURG, MS 39180
(601) 636-1231

DCA PROJECT PRELIMINARY REPORT
By: W. H. Gastrock

The following processes for production of > 97% DCA have been examined on the basis of projected raw material costs and waste costs:

1. CEDAR PROCESS
   a. ODCB nitration (91.5% 3,4-DCNB)
   b. Purification by sulfonation (99% 3,4-DCNB)
   c. Catalytic hydrogenation (98% 3,4-DCA)

2. MONSANTO PROCESS
   a. ODCB nitration (? % 3,4-DCNB)
   b. Catalytic hydrogenation (? % 3,4-DCA)
   c. Purification by distillation (98% 3,4-DCA)

3. p-CHLORONITROBENZENE PROCESS
   a. PCNB chlorination ( 98% 3,4-DCNB)
   b. Catalytic hydrogenation (97% DCA)

DOES NOT INCLUDE CAPITAL COST.

The production costs for DCA have been estimated to be $0.16/lb DCA at a production rate of 840,000 lb/mo (Tom Lodice, May 19, 1986, DCA Proposal).

## DCA BY CEDAR PROCESS

| Raw Material | Usage (lb/lb DCA) | Price ($/lb) | Cost Contribution ($/lb DCA) |
|---|---|---|---|
| ODCB | 1.096 | 0.56 | 0.614 |
| 35% oleum | 1.380 | 0.083 | 0.115 |
| 98% $HNO_3$ | 0.485 | 0.144 | 0.070 |
| $H_2$ | 0.041 | 1.78 | 0.073 |
| morpholine | 0.0018 | 1.00 | 0.002 |
| $NaHCO_3$ | 0.012 | 0.18 | 0.002 |
| 1% Pt/C | 0.0006* | 45.53 | 0.027 |
| | | Total | $0.90/lb DCA |

* Catalyst usage from Monsanto

### WASTE COSTS

| | lb/lb DCA | gal/lb DCA | Price ($) | Cost ($/lb DCA) |
|---|---|---|---|---|
| 1. Nitration spent acid | | | | |
| $NH_3$ neutralization | 0.277 | - | 0.073 | 0.020 |
| Disposal | 2.70 | 0.27 | 0.32 | 0.086 |
| 2. Spent sulfonation acid | | | | |
| $NH_3$ neutralization | 0.284 | - | 0.073 | 0.025 |
| Disposal | 2.78 | 0.28 | 0.32 | 0.090 |
| 3. Reduction aqueous waste | 0.48 | 0.06 | 0.32 | 0.019 |
| | | | Total | $0.24/lb DCA |

DCA BY MONSANTO PROCESS

| Raw Materials | Usage (lb/lb DCA) | Price ($/lb) | Cost Contribution ($/lb DCA) |
|---|---|---|---|
| ODCB | 1.178 | 0.56 | 0.660 |
| $H_2SO_4$(98%) | 1.165 | 0.053 | 0.062 |
| $HNO_3$(98%) | 0.539 | 0.144 | 0.078 |
| $H_2$ | 0.066 | 1.78 | 0.117 |
| 1% Pt/C | 0.0006 | 45.53 | 0.027 |
| $Na_2CO_3$ | 0.036 | 0.20 | 0.007 |
| | | | Total $0.95/lb DCA |

WASTE COSTS

| | lb/lb DCA | gal/lb DCA | Price ($) | Cost($/lb DCA |
|---|---|---|---|---|
| 1. Spent acid | | | | |
| $NH_3$ neutralization | 0.45 | - | 0.0725 | 0.033 |
| Disposal | 4.40 | 0.44 | 0.32 | 0.141 |
| 2. Reduction aqueous | 0.39 | 0.047 | 0.32 | 0.015 |
| 3. Organics from distillation | 0.30 | - | 0.45 | 0.135 |
| | | | Total | $0.32/lb DCA |

DCA BY PCNB ROUTE

| Raw Materials | Usage (lb/lb DCA) | Price ($/lb) | Cost Contribution ($/lb DCA) |
|---|---|---|---|
| PCNB | 1.017 | 0.82 | 0.834 |
| $Cl_2$ | 0.503 | 0.053 | 0.025 |
| $FeCl_3$ | 0.039 | 0.36 | 0.014 |
| $H_2$ | 0.041 | 1.784 | 0.073 |
| morpholine | 0.0018 | 1.00 | 0.002 |
| 1% Pt/C | 0.0006 | 45.53 | 0.027 |
| | | | Total $0.98/lb DCA |

WASTE COSTS

| | lb/lb DCA | gal/lb DCA | Price ($) | Cost($/lb DCA) |
|---|---|---|---|---|
| 1. Scrubber NaOH | 0.339 | - | 0.1585 | 0.054 |
| neutralization Disposal | 2.0 | 0.21 | 0.32 | 0.067 |
| 2. Reduction aqueous | 0.48 | 0.06 | 0.32 | 0.019 |
| 3. Aqueous $FeCl_3$ | 1.04 | 0.12 | 0.32 | 0.038 |
| | | | Total | $0.18/lb DCA |

SUMMARY

DCA RAW MATERIAL AND WASTE COST

| | MONSANTO PROCESS | CEDAR PROCESS | PCNB PROCESS |
|---|---|---|---|
| Raw Materials | $0.95 | $0.90 | $0.98 |
| **Waste** | | | |
| All off-site disposal | $0.32 | $0.24 | $0.18 |
| RM + waste | ($1.27) | ($1.14) | ($1.16) |
| **Waste** | | | |
| With nitration spent acid returned for recycle | $0.15 | $0.14 | $0.18 |
| RM + waste | ($1.10) | ($1.04) | ($1.16) |
| **Waste** | | | |
| Spent acid for recycle | $0.13 | $0.12 | $0.16 |
| Reduction aqueous handled on site | | | |
| RM + waste | ($1.08) | ($1.02) | ($1.14) |

RAW MATERIAL PRICES

| | Price ($/lb) | Freight ($/lb) | Total $/lb) |
|---|---|---|---|
| p-chloronitrobenzene (PCNB)[1] | 0.75 | 0.07 | 0.82 |
| Chlorine[2] | 0.05 | - | 0.05 |
| NaOH (100%)[1] | 0.138 | 0.02 | 0.158 |
| o-dichlorobenzene (ODCB)[1] | 0.51 | 0.05 | 0.56 |
| 35% oleum[1] | 0.043 | 0.04 | 0.083 |
| 98% $H_2SO_4$[1] | 0.0325 | 0.02 | 0.144 |
| 98% $HNO_3$[1] | 0.124 | 0.02 | 0.144 |
| hydrogen[3] | 1.78 | - | 1.78 |
| ammonia[4] | 0.0725 | - | 0.0725 |
| morphaline[4] | 1.00 | - | 1.00 |
| $NaHCO_3$[4] | 0.18 | - | 0.18 |
| $Na_2CO_3$[4] | 0.20 | - | 0.20 |

1. Charlie Parker
2. Jeff Horn
3. Stanley Bernard
4. CMR

**CEDAR INTERNAL CORRESPONDENCE**

DATE: September 4, 1987

TO: Ron Cheves

FROM: G. L. Pratt

CC: Frank Barry
John Bumpers
Niven Morgan
John Miles
Craig Keese

SUBJECT: High Pressure Project

It is proposed to build a high pressure reaction system at West Helena so that Cedar can respond to the many inquires received for toll production requiring high pressure equipment.

Since 3,4 dichloroaniline could be produced in such a system, economics to justify its construction based on 3,4 dichloroaniline production alone are presented. These are supplemented in a second study attached in which a 4 month hypothetical project is inserted in the 6-7 months per year unused by dichloroaniline production.

Specifically for dichloroaniline:
Attached is a report dated May 19, 1986 by Tom Lodice containing a proposal to build a 3,4 dichloroaniline plant at West Helena. Most of the data in the report is applicable today with the following execptions:

1. The RP 10 plant can adequately handle the nitration portion of the DCA process and thus the capital estimate can be lowered from 1.2 million dollars (page 14 in the report) to $870,000.

2. The raw material costs (see page 17 of the report) are currently being updated. Unconfirmed data indicates that current raw material cost will be roughly $.05 per pound of DCA higher than the 79.8 cents per pound quoted in the report.

In addition to the equipment capital, $200,000 has been allowed for catalyst inventory. No allowance has been made for working capital to cover raw materials or the finished product.

Each year is a hypothetical year since the timing of project approval would influence the impact of making our own DCA in a particular year. For "1988" the production quantity is based on Cedar's forecasted needs for propanil production. In "1989" it was assumed that Cedar would provide the DCA for the approximately 300,000 gallons of Rohm & Hass STAM which we currently toll produce. In "1990" it was assumed that we would provide roughly half the DCA required by Cumberland. No provision has been made for a DCA market beyond these suppliers of propanil.

September 2,1987

High Pressure System

| Year | DCA 1988 | X 1988 | DCA 1989 | X 1989 | DCA 1990 | X 1990 |
|---|---|---|---|---|---|---|
| Revenue M-$ | 2600.0 | 900.0 | 3900.0 | 900.0 | 5070.0 | 900 |
| Production MM-lbs | 2.00 | | 3.00 | | 3.90 | |
| Price $/lb | 1.3 | | 1.3 | | 1.3 | |
| Capital M-$ | 1070.0 | 230.0 | | | | |
| Proc Cost M-$ | 455.6 | 536.0 | 469.4 | 536.0 | 610.2 | 536.0 |
| Raw Mat Cost M-$ | 1700.0 | 0.0 | 2550.0 | 0.0 | 3315.0 | 0.0 |
| Gross Profit M-$ | 444.4 | 364.0 | 880.6 | 364.0 | 1144.8 | 364.0 |
| Deprec Old M-$ | 34.0 | 40.0 | 35.0 | 40.0 | 46.0 | 40.0 |
| Deprec New M-$ ROI | 107.0 | 23.0 | 107.0 | 23.0 | 107.0 | 23.0 |
| M-$ ROCE | 214.0 | 46.0 | 214.0 | 46.0 | 214.0 | 46.0 |
| Cap Resid ROI M-$ | 906.7 | 970.8 | 570.9 | 389.0 | -165.3 | -347.2 |
| ROCE M-$ | 854.4 | 905.8 | 456.7 | 265.1 | -328.6 | -520.2 |
| Memphis OH M-$ | 78.0 | 27.0 | 117.0 | 27.0 | 152.1 | 27.0 |
| Interest ROI M-$ | 128.4 | 27.6 | 116.5 | 0.0 | 46.7 | 0.0 |
| ROCE M-$ | 115.6 | 22.4 | 109.2 | 0.0 | 78.0 | 0.0 |
| Net Profit BFIT | 97.0 | 246.4 | 505.1 | 274.0 | 793.0 | 274.0 |
| Net Profit BFIT | 2.8 | 228.6 | 405.4 | 251.0 | 654.7 | 251.0 |
| Net Profit AFIT | 56.3 | 142.9 | 293.0 | 158.9 | 459.9 | 158.9 |
| Net Profit AFIT | 1.6 | 132.6 | 235.1 | 145.6 | 379.7 | 145.6 |
| ROI | 15.3 | | 34.8 | | 47.6 | |
| ROCE Project Basis | 11.5 | | 41.8 | | 80.8 | |

File: DCA Cashl 

September 2,1987

Dichloraniline

| Year | 1988 | 1989 | 1990 | 1991 | 1992 |
|---|---|---|---|---|---|
| Revenue M-$ | 2600.0 | 3900.0 | 5070.0 | 5070.0 | 5070.0 |
| Production MM-lbs | 2.00 | 3.00 | 3.90 | 3.90 | 3.90 |
| Price $/lb | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| Capital M-$ | 1070.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Proc Cost M-$ | 455.6 | 469.4 | 610.2 | 610.2 | 610.2 |
| Raw Mat Cost M-$ | 1700.0 | 2550.0 | 3315.0 | 3315.0 | 3315.0 |
| Gross Profit M-$ | 444.4 | 880.6 | 1144.8 | 1144.8 | 1144.8 |
| Deprec Old M-$ | 34.0 | 35.0 | 46.0 | 46.0 | 46.0 |
| Deprec New M-$ ROI | 107.0 | 107.0 | 107.0 | 107.0 | 107.0 |
| M-$ ROCE | 214.0 | 214.0 | 214.0 | 214.0 | 214.0 |
| Cap Resid ROI M-$ | 906.7 | 502.3 | -56.7 | -650.7 | -1244.7 |
| ROCE M-$ | 854.4 | 393.9 | -225.1 | -876.1 | -1515.0 |
| Memphis OH M-$ | 78.0 | 117.0 | 152.1 | 152.1 | 152.1 |
| Interest ROI M-$ | 128.4 | 108.8 | 60.3 | 0.0 | 0.0 |
| ROCE M-$ | 115.6 | 89.7 | 34.4 | -39.8 | 0.0 |
| Net Profit BFIT | 97.0 | 512.8 | 779.4 | 839.7 | 839.7 |
| Net Profit BFIT | 2.8 | 424.9 | 698.2 | 772.5 | 732.7 |
| Net Profit AFIT | 56.3 | 297.4 | 452.0 | 487.0 | 487.0 |
| Net Profit AFIT | 1.6 | 246.4 | 405.0 | 448.1 | 424.9 |
| ROI | 5.3 | 27.8 | 42.2 | 45.5 | 45.5 |
| ROCE Project Basis | .2 | 32.9 | 75.7 | 139.6 | 397.1 |

Date: March 3, 1993

To: N. Robbins

CC: D. Hoppel
M. Pocrass

From: P. Schweikert

Subject: Caustic Usage in DCA

A study of the DCA log book for the period of September 18, 1992 to January 31, 1993 only shows the use of caustic on 11 occasions. A total of 25,000 pounds of 17% caustic was used to produce 2.2 MM pounds of DCA product. This amounts to a usage rate of 0.0114.

During the winter time due to caustic line freeze-ups, the neutralizer of choice is soda ash which is dumped into the sump and pumped to the wastewater tank. It will be necessary to check and make sure that this miscellaneous usage is being reported.

The wastewater streams to the neutralization tank vary from acidic to basic and the tank is usually neutral and does not require that any material be charged to it. It should be expected that in the summer time caustic usage will be approximately double the rate stated above.

PS

50% @ .003